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THE SAXBY AND FARMER SAFETY SWITCHES AND SIGNALS.

We have heretofore had occasion to notice, in the SCIENTIFIC AMERICAN, the merits of the Saxby and Farmer interlocking system, as applied to railway points and signals, which, for nearly ten years past, has been in operation upon the principal English railroads. It has proved successful to such a degree that, by act of Parliament, its use has been rendered obligatory on all new lines in England.

The remarkable capabilities of the invention, in controlling the most intricate sets of switches, is practically exemplified at the Waterloo junction station, London. We have before us a photograph of the operating works at this station, at which no less than 108 switch and signal levers, all connected with the many tracks at this junction, are contiguously employed.

It is gratifying to know that this valuable improvement, which is certainly one of the most important of all safeguards against switch accidents, is now being extensively introduced in this country. The Pennsylvania Railway Company, animated by the highly creditable desire to provide their road with the best safety appliances, have lately put up, at the East Newark junction, on the suggestion of Mr. G. O. Howell, principal assistant engineer of the New Jersey Division, a splendid example of the Saxby and Farmer system. The engravings herewith presented are taken from these works. We understand that plans, for the employment of the system at the grand depot of the same company at Jersey City, are now in progress. We hear that the invention will also be employed at the railway junctions on the Centennial Exhibition grounds, Philadelphia, Pa., next year.

Fig. 1.—SAXBY AND FARMER'S SYSTEM OF RAILWAY SWITCHES AND SIGNALS.

Unless an engine driver deliberately shuts his eyes to prominent danger signals and intentionally dashes his train to destruction, it would seem that with the Saxby and Farmer mechanism an accident is hardly possible. The switch tender is utterly precluded from making a blunder either in signals or in locking or setting his points. The very worst he can do is to neglect his duty altogether, and the only result arising therefrom would be a temporary stoppage of the trains. He cannot shift points during the passage of a train and so send the rear cars off the track, nor can he easily signal a line clear until such is the case. The characteristic feature of the Saxby and Farmer system is its absolute positiveness.

Our artist contributes in Fig. 2 a sketch of the locality at East Newark, N. J., showing the converging tracks leading from different portions of Newark to the junction, and on the left the Saxby and Farmer signal cabin, within which all the levers which control the signals and switches are located. Beside the tracks are the home and distant signal posts, the arms of which are always extended, indicating danger, except when lowered by the operator for a few seconds, to signify that the passage is clear. The distant signals are cautionary, and placed 2,100 feet from the switches, and the engine driver, if the signal arm denotes danger, slows down at once and runs to the home post near the switches, and there stops and awaits the giving of another signal before proceeding.

Fig 2.—SIGNAL HOUSE, SWITCHES, AND SIGNALS.

The large illustration, Fig. 1, represents the interior of the signal cabin, the upper story of which is surrounded by windows, affording a clear view in all directions. Here is located the row of levers and the governing mechanism, while beneath the flooring are the counterweights, together with the heavy rods and wire cords which lead to the various points which are to be controlled. The rods and cords extend from the cabin underground, in tubes, to the signals that are to be operated, the most distant of which is nearly half a mile away from the cabin. A sectional view of the lever mechanism is shown in Fig. 3. Just in the rear of the bank of levers is a frame containing two sets of rods, which fit in slots in the extremities of the frame, and have a free longitudinal motion. Connected with each lever arm is a locking bar, which, beside serving as a latch to hold the lever either upright or inclined, also tilts a link which in turn oscillates a slotted piece of metal attached to the lever, and arranged at right angles to the sliding bars, and between them. As the slotted piece is turned, certain dogs or projections on the sliding bars engage in the slots, so that by this means certain levers other than the one or ones moved are rendered entirely immovable, through the bars being thus firmly held. It will be seen at once that, if these hooked projections on the bars be made adjustable, they may be so set and fastened that several of the levers may be locked by the motion of one, and, conversely, that it may be necessary to change the position of several levers before one can be operated. Now in this latter case, if it be supposed that the levers which must be operated first serve to lock facing points, or to cut off connection to a line to be kept clear, then it will be seen that, until this is done, the last lever which sets the signal right cannot be moved. And this is the governing principle of the entire system.

The levers, in order to be readily distinguished, are numbered, and painted in different colors. A black lever moves the switch points, and this it does by the positive connection of bell cranks and rods, leading to a bar between the points. A blue lever governs the locking mechanism which holds the latter in place. The same mode of communication leads to a long pivoted plate lying beside one rail, which, when the lever is changed,

rises up like one side of a parallel ruler, a little above and to one side of the rail, and swings over to a new position. The plate connects with a three-way crank, and the latter with bolts which shoot into the cross piece between the points. It is obviously impossible for the plate to swing over during the passage of a train, for the wheels prevent. Red and green levers manage the home and distant signals, and by suitable wire cords either turn the lights or lower the arms, arms being exhibited by day and lights at night. In rear also of the levers is a plate, showing their uses; and numbers on each serve to individualize them in accordance with a plan of the switches, etc. On each signal lever, besides its number, are marked the numbers of the other levers which must be moved before it can be, so that the operator is provided with every means for showing him instantly what he has to do. It is impossible for him to move No. 2 signal, for example, until he has moved point lever 7 and locked it by lever 8; and then after he has pulled No. 2, that very operation prevents his stirring Nos. 11 and 15, which govern points crossing to the line shown clear by the signal; nor can he move No. 14, which might enable him to give a safety signal to lines which the open road crosses. A point lever cannot be stirred when a signal which should be at danger stands at safety. In brief, the device resembles a kind of permutation lock, each portion of which is both latch and key; sometimes the projections on the bars which serve as the tumblers cause said bars to be shoved to one side, throwing other bars into or out of engagement—and thus all parts are inter-related in an ingenious manner.

The levers are all worked by one man, and he is instructed by the telegraph, the operator and instruments being located in the same apartment with him. The instant the wires deliver the message the levers are quickly moved, and in a few seconds the smoke of the approaching locomotive is seen far down the line. Should any part of the mechanism break, even at the last minute, there is no peril incurred. If any portion of the locking or switch gear give way or get out of adjustment, the signal lever cannot be stirred, and the semaphore arm remains at danger—its normal condition; so, also, if the signal mechanism itself rupture, the result will be negative, for the arm, being counterweighted, will not fall of itself, and, from the break, cannot be pulled down. The levers are moved in an instant; twenty seconds suffices at the Cannon street station in London to move ten pairs of points and all the signals belonging to them. We need not suggest the number of hands and the length of time which would be required to do the same under the old systems, nor the economy in expense and freedom from risk involved in the substitution of the new method.

Mr. Joseph Dixon, Secretary of the Broadway Underground Railway Company, is the agent for Messrs. Saxby & Farmer in this country, and from him, at the office of the above named corporation, 263 Broadway in this city, further and more minute particulars may be obtained. The mechanism in the locality above described was manufactured in the factory of the inventors, an immense establishment in London, N. W., employing some 1,800 men, and imported hither. Certainly, the invention is one of surpassing importance and value; and with that conviction we can confidently direct to it the attention of the railway companies, as well as that of the public in general.

A kind of tracing paper, which is transparent only temporarily, is made by dissolving castor oil in absolute alcohol and applying the liquid to the paper with a sponge. The alcohol speedily evaporates, leaving the paper dry. After the tracing is made, the paper is immersed in absolute alcohol which removes the oil, restoring the sheet to its original opacity.

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NEW YORK, SATURDAY, APRIL 3, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

SCIENCE IN COMMON SCHOOLING.

If it were possible to dispossess an average school boy of all the mental development and discipline, with all the knowledge, general and special, which he did not get in school, there would, we fear, be precious little left for the schoolmaster to take pride in. Still more, were it possible to set off, against the certain benefits of schooling of the usual sort, the advantages which a better ordered system of primary culture would afford, the popular appreciation of the schools would, we are certain, be seriously disturbed.

There are few places that can boast a more liberal scheme of public schooling—liberal, that is, in time and material—than this city of New York. Her children may begin with the alphabet and end with a college diploma without other aid than that which the free schools afford. Yet the records of the schools show that, of the hundreds of thousands of children who have begun their schooling in them, more than half have gone out unable to read intelligently an easy page of print. Of those that are able to stay longer—that is, more than three or four years—it is but the fortunate few who are able, when their school days come to an end, to read with understanding the foreign telegrams in the morning paper; probably to not one in a hundred is the daily report of prices current any more intelligible than a page of integral calculus.

The fault lies less with the brevity of their school life than with the misuse of it which the school system entails—a system which makes a fetich of alphabet and multiplication table, and wastes on these tools of culture the children's best opportunities for gaining power to use them.

To insist that Science teaching be grafted on a system whose practical results are so meager is only to make matters worse. The sciences belong to a higher level of education, and should be left for riper years. At this stage of the child's development, the Sciences, as systematized groupings of related facts and principles, have no existence, only objects and sensations, palpable facts and tangible relations, have being in the child world; and the child is merely the observing traveler and explorer. The scientific geographer, geologist, and the rest come later. Could we control the work of the common school, therefore, we should rigorously exclude all Science teaching, real or pretended, and all teaching not scientific.

Schoolmasters who imagine that teaching scientifically means cramming children with facts, principles, and theories in geography, grammar, physiology, physics, and what not may accuse us of making a distinction where there is no difference; but the difference is as wide as between right and wrong. The most unscientific teaching which the common schools—and not a few of our higher schools, also—are guilty of appears in their teaching of the sciences. We would have none of it. Nevertheless, we say, as we have said before, that to educate truly, the work of the primary school, in matter and spirit and method, should be, from first to last, purely scientific. In other words, the work of the primary schools should be shaped to accomplish these three ends:

(1) The systematic development and training in quickness, keenness, and accuracy of all the child's faculties of sense, through the pleasurable exercise of the senses; for in primary culture joy is the great quickener and inspirer of effort.

(2) The systematic development of the child's mental faculties by varied acts of discrimination, judgment, and memory, dealing primarily, if not exclusively, with sensations.

(3) The formation of right habits in knowledge-getting, and in applying knowledge, through the personal observation, handling, investigation, and using of common things.

As the young surgeon is set to study the human body; as the student of mining engineering is made sensibly acquainted with the ores he expects to deal with, their mineral associates, and the conditions of their existence; as the practical machinist studies mechanics, so the child should be taught to study the world he has come to live in; not as a specialist in Science, but as a practical man, determined to master his environment. In this way only can his powers of sense and intellect be rightly developed and trained, and he be fitted to play well his part in the great game of life.

To this end letters are useful as auxiliaries, and for the cultivation of the wide fields of thought that lie without the pale of Science; but they should not be made the beginning nor the end of instruction. If one part in ten of a child's school life be devoted to letters, and the rest employed as we have indicated, he will not make less progress in reading than if the whole time be given to them; and he will be immensely better fitted to turn the art to advantage in after years. Besides, if the child's schooling be untimely cut short, as now happens in the majority of cases, his scientific training would fit him to make something, nay, to make the most, of his out-of-school opportunities. Far better absolute ignorance of letters, with the inquiring habits of mind and educated senses to be got by scientific training for a year or two, than the half-acquired art of reading, which the majority of children carry from the schools, weighted with the unawakened faculties and apathy of knowledge which they too commonly exhibit.

SYRIAN SPONGES.

The latest project before the Acclimatization Society of Paris is the cultivation of the celebrated Syrian sponge in the waters of Southern France, a valuable and most useful product, which, like many another gift of the sea, is in danger of extermination through excessive fishing.

The sponge-producing grounds of Syria occur along the coast, from Mount Carmel in the south to Alexandretta in the north, the centers of production being Tripoli, Ruad, Lattakia, and Bartroun, on the coast of Mount Lebanon. The best qualities are found in the neighborhood of Tripoli and Bartroun. According to a late report of the British vice consul at Beyrout, as many as three hundred boats are engaged in the fishery; the annual yield, though falling off through the exhaustion of the grounds, still amounts to $100,000 to $125,000. The majority of the boats used are ordinary fishing boats, from eighteen to thirty feet in length, three parts decked over, and carrying one mast with an ordinary lug sail. They are manned by a crew of four or five men, one to haul and the rest to serve as divers.

In former years the coast was much frequented by Greek divers from the islands of the Archipelago; the number is now restricted to five or six boats a year, the skill of the Syrian combined with his better knowledge of the fishing grounds, enabling him to compete successfully with his foreign rival.

Diving is practised from a very early age up to forty years after which few are able to continue the pursuit profitably. The depth to which the diver descends varies from five to thirty "brasses," or from twenty-five to one hundred and seventy-five feet. The time he is able to spend under water depends on natural capacity, age, and training; sixty seconds time is reckoned good work—in rare instances eighty seconds are spent under water. The Syrian diver uses a heavy stone to carry him quickly to the bottom, and is drawn up by a comrade. On the bottom, he holds the guide rope with one hand and tears off the sponges with the other, placing them in a net which he carries. No knife, spear, or instrument of any kind is used in detaching the sponges; nor does he, like his Greek competitor, ever use the divivg dress, having an antipathy to it on the score of its reputed tendency to produce paralysis of the limbs. Two or three fatal accidents occur annually, mainly among the skillful and daring, who sometimes drop the rope to secure a tempting prize, and

missing it on their return, attempt to rise to the surface unaided, and are drowned. At other times the diver will be wounded by jagged rocks, or his rope will become entagled, exposing him to great risks where the depth is great.

Though varying much in quality and size, the sponges are roughly divided into three classes: (1) The fine white bell-shaped sponge, known as toilet sponge; (2) the large reddish variety called bath sponge; (3) the coarse red sponge used for household purposes, carriage cleaning, etc. Two thirds of the produce of the Syrian coast are purchased by native merchants for exportation, while the remaining third is purchased on the spot by French agents. France takes the bulk of the finest qualities. One tenth the price received by the finders goes to the government for revenue.

It is possible that this high-priced and durable variety of sponge might be cultivated in our southern waters, as a substitute for the beautiful but tender sponge they now yield. The experiment would be worth trying.

INSPECTION OF BOILERS.

We have recently received the report of the Hartford Steam Boiler Inspection and Insurance Company for 1874. These annual reports always contain a great deal of information valuable to steam users, and we give a summary of the present one.

The company report the total number of boiler explosions of which they have knowledge, occurring during the year in the United States and Canada, to be 105, killing 183 persons and injuring 199. They were only able to ascertain the causes of a few of these explosions, but venture the opinion that they might have been prevented in great part by a system of careful inspection. As we have already explained to our readers, the ground in England is so well occupied by boiler insurance companies that the cause of every explosion is carefully investigated; and the results of these investigations confirm the opinion of the Hartford company, that boiler explosions can be prevented.

During the year, the company inspected 29,200 boilers. Of this number, 9,451 inspections were internal and complete, and the hydraulic test was applied to 2,078 boilers. The number of defects discovered by these inspections was 14,256, of which 3,486 were regarded as dangerous, or, in other words, the company declined to take any risks until the defects were remedied. The report is mainly taken up with explanations of the nature of these defects and the proper remedies. It is not uncommon to find a furnace out of shape, or with a fractured sheet, as the result of overheating and sudden cooling. Blisters in plates are caused by imperfections in the iron. They should be trimmed off and a patch applied, if the thickness of the sheet is much reduced. External corrosion is caused by exposure to the weather, leaky fittings, and the like. Boilers should be set so that they can readily be examined externally. Internal corrosion is ordinarily caused by acids in the feed water, and the remedy is, of course, to purify or change the feed. In cases of internal corrosion, some plates of a boiler will be clean and bright, while others are corroded and pitted. This seems to be due to differences in the iron composing the sheets. Internal grooving is caused by change of shape, due to varying temperature and the action of acids in the feed water.

One of the most common difficulties is caused by the deposit of scale in boilers. The principal impurities in water are lime, sodium, and magnesia, with salts of iron and organic matter. The carbonate of lime is deposited in the form of a soft slush; but combined with other impurities, it forms a hard scale. If a boiler is blown out while the water is hot, this slush remains, and is baked into a hard mass; but by allowing the water to cool, and then letting it run out, the slush can readily be removed by a stream of water from a hose. The sulphate of lime, unlike the carbonate, forms a hard scale at once, and is, therefore, much more troublesome than the carbonate. It becomes necessary in such a case to use some kind of scale preventive. The company hesitate to recommend any of the patent compounds in the market, since it is impossible to say that a preparation which is good for one boiler will be good for all. Frequent blowing will be found very beneficial, lowering the water level two or three inches at a time. Potatoes act mechanically, enveloping the deposits and preventing their adherence to the boiler. Petroleum has been found useful in some cases, but its general application is not recommended. Astringents, containing tannic acid, decompose the carbonates, forming insoluble tannates; but the tannic acid in some cases attacks the iron of the boiler. Common soda appears to be one of the best solvents, being introduced with the feed, in ordinary cases in quantities of from 1 to 2 pounds a day. Whenever solvents of any kind are used, the boiler should be cleaned frequently. The use of feed water heaters, to collect the impurities, has been recommended in former reports. These views are entitled to great respect, from the extensive experience of the company with deposits in boilers and the means of preventing and removing them. We can fully indorse the recommendations given above.

While we have necessarily been brief in our review of this admirable report, we have endeavored to notice all the most important points.

MICHIGAN'S SALT INTERESTS.

The first establishment for the production of salt in Michigan went into operation in the spring of 1860. Four thousand barrels were made the first year. In 1864, the yield was upwards of half a million barrels. The next five years showed little progress; since then the gain has been steady until 1874, when the total product was 1,026,979 barrels. Thus in fifteen years the Saginaw Salt Springs have become as productive as the Kanawha (Va.) Springs, where the manufacture of salt has been carried on since 1804; and two thirds as productive as our New York springs, where the manufacture was begun as early as 1797. The manufacturing capacity of the salt works of Michigan is now about 1,800,000 barrels a year: the total product since 1860 being nearly eight million barrels. Owing to the constant efforts of the State Inspector, and the intelligent care of the manufacturers, during the past two or three years the quality of the salt produced in Michigan has been much improved, so that it begins to compare favorably in the markets with the products of Onondaga.

The first satisfactory evidence of saline waters in the State, of a strength to make the manufacture of salt profitable, was published by the State Geologist, Dr. Haughton, in 1840. The untimely death of that gentleman deprived the State of its main reliance for giving intelligent direction to the development of the industry which promised so much advantage, and the interest languished for twenty years. Since 1860, as we have already seen, the correctness of Dr. Houghton's opinions have been amply demonstrated.

The primary source of the brines of Michigan is not yet fully determined, though indications point strongly to a deposit of rock salt underlying a large portion of the northern part of the Lower Peninsula. No borings have yet demonstrated this theory; still such would seem to be the most probable source of the present supply of brine. The immediate sources of the saline waters appear to be areas of depression in the strata known as the Michigan salt group and the contiguous sandstones above and below. Along the Saginaw Valley, the depression seems to be greatest, and here the brines have the highest specific gravity. The rocks which furnish the brine lie a thousand feet or so below the level of the lakes, and all wells carried to a sufficient depth in this region are sure to yield rich and productive brines. The quantity of brine seems to be unlimited. The strength of the brine increases with the depth; in the first well sunk it marked 1 degree at the depth of 90 feet; 40° at 516 feet; 60° at 559 feet, and 90° at 636 feet.

Borings have also been made in the Michigan representatives of the Onondaga salt group, which furnish the brines of New York, but thus far they have failed to afford more than a reasonable hope that these rocks may yield brines sufficiently strong to be worked with profit.

The salt-producing territory of the State is divided into twelve inspection districts, comprising sixty-eight salt companies, working forty kettle blocks, as many steam blocks, twenty-two pan blocks, and forty-four hundred solar salt covers.

The first variety of salt block consists of fifty or sixty kettles and the stone or brickwork in which they are set, a protecting building from 75 to 100 feet long and about 20 feet high in the center, and sheds on each side containing drainage bins. The brine is pumped to vats, near each block, whence it is carried in pump logs along the brickwork between the double rows of kettles, with a spout for each kettle.

The process of manufacture is very simple. The kettles are filled with brine and heated, and the scum which rises is skimmed off. Then the brine is boiled, whereupon crystals of salt form on the top and fall to the bottom. When the brine is about half evaporated, the salt is dipped out and thrown into baskets to allow the mother liquor to drain away.

In the steam process, the brine, after settling in vats as in the kettle process, is drawn into the steam settlers, strong wooden cisterns, from 100 to 120 feet long, 8 feet wide, and 6 feet high. Here the brine is heated by steam pipes until brought to complete saturation; then after standing awhile to settle, the clear brine passes to the grainers, which are wooden vats differing from the settlers only in being shallow, and heated in the same way. The saturated brine begins to deposit salt at once, and in the course of twenty-four hours is exhausted. During this time the hot brine is constantly stirred, making the crystals fine. The salt is then thrown out upon draining boards; thence it is taken to the packing house, where it remains a fortnight for complete drainage, before it is packed in barrels.

A pan block is a building large enough to cover the settler, the pans, and the packing room. From the settlers the saturated brine is drawn to the pans, set in flues so that the heat is applied at bottom. In this process—which is considered most economical—the evaporation is very rapid, and the salt makes continually, with great economy of heat.

The solar process is the simplest of all, the evaporation being effected by sun heat alone. Shallow wooden vats, 18 feet square, are employed, each provided with a movable roof or cover, so as to protect or expose the brine as the weather may require. The evaporation begins in April, or as early as the weather becomes sunny, and continues until November. The first crop of salt is gathered about the middle of July, the second in September, and a third in October. The middle crop is the most valuable, owing to its greater coarseness. About a tenth of a crop is gathered in November, which ends the season. The annual product of a "cover" is about fifty bushels.

Four grades of salt are recognized by the State Inspector, to whose annual report, for 1874, we are indebted for the foregoing information:

Fine salt: Suitable for general use for family purposes. Made with artificial heat; of this grade the yield last year was 960,757 barrels.

Packers' salt: Suitable for packing and bulking meat and fish. Yield, 20,000 barrels.

Solar salt: Coarse and fine. Claimed to be equal to the best Onondaga solar. Yield, 29,391 barrels.

Second quality salt: Includes all salt intended for No. 1 of the foregoing grades, but not up to the standard. Good for salting stock, hay, hides, etc. Yield, 16,741 barrels.

THE MISSION OF THE FLY.

The generally received opinion about flies is that, despite limitless ingenuity expended on patent traps and poisoned paper, they form one of those ills of life which, it not being possible entirely to cure, must perforce be endured with as good a grace as may be. Consequently when they ruin our picture frames and ceilings, insinuate themselves into our milk and molasses pitchers, or lull us to sleep with their drowsy buzzing, only to bite us during our slumbers and render the same uneasy, we thank fate that the cold weather will rid us of the pest. To be sure they are scavengers in their way; but after we have spent several minutes in picking a score or more out of the butter dish, we arrive at the conclusion that it is an open question whether they do not spoil more good material than they carry off bad.

Festina lente, good reader, hasten slowly and do not anchor faith to such opinions until you are certain that the above sum up all of the fly's mission in this world. *Musca domestica* (Science uses six syllables in Latin to express that which good round Saxon epitomizes in two) is a maligned insect. He fulfils a purpose of sufficient moment to cause you to bear his inroads into your morning nap with equanimity, o even complacently to view him congregated by the score within your hidden sweets.

Did you ever watch a fly who has just alighted after soaring about the room for some little time? He goes through a series of operations which remind you of a cat licking herself after a meal, or of a bird pluming its feathers. First, the hind feet are rubbed together, then each hind leg is passed over a wing, then the fore legs undergo a like treatment; and lastly, if you look sharp, you will see the insect carry his proboscis over his legs and about his body as far as he can reach. The minute trunk is perfectly retractile, and it terminates in two large lobes, which you can see spread out when the insect begins a meal on a lump of sugar. Now the rubbing together of legs and wings may be a smoothing operation; but for what purpose is this carefully going over the body with the trunk, especially when that organ is not fitted for licking, but simply for grasping and sucking up food.

This query, which perhaps may have suggested itself to thousands, has recently for the first time been answered by a Mr. Emerson, an English chemist; and certainly in the light of the revelations of that gentleman's investigations, the fly assumes the position of an important friend instead of a pest to mankind. Mr. Emerson states that he began his self-appointed task of finding out whether the house fly really serves any appreciable purpose in the scheme of creation, excepting as an indifferent scavenger, by capturing a fine specimen and gluing his wings down to a microscope slide. On placing the slide under the instrument, to the investigator's disgust the fly appeared covered with lice, causing the offending insect to be promptly released and another substituted in his place. Fly No. 2 was no better off than fly No. 1, and as the same might be predicated of flies 3, 4, 5 (or of *n* flies, as the algebras have it), Mr. Emerson concluded that here was something which at once required looking into. Why were the flies lousy? Meanwhile fly No. 2, on the slide, seemed to take his position very coolly, and, extending his proboscis, began to sweep it over his body as if he had just alighted. A glance through the microscope, however, showed that the operation was not one of self-beautification; for wherever the lice were, there the trunk went. The lice were disappearing into the trunk; the fly was eating them. Up to this time, the investigator had treated his specimen as of the masculine gender; but now he changes his mind and concludes it to be a female, busily devouring not lice but her own progeny. The flies then carry their young about them; and when the family get too numerous or the mother too hungry, the offspring are eaten.

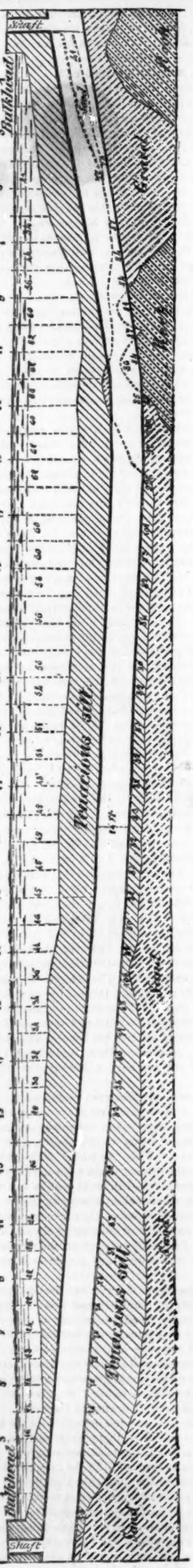
Awhile reasoning thus, Mr. Emerson picked up a scrap of white writing paper, from which two flies appeared to be busily eating something, and put it under the instrument. There were the progeny again on the paper, and easily rubbed off with a cloth. "This," he says, "set me thinking. I took the paper into the kitchen again and waved it around, taking care that no flies touched it, went back to the microscope and there found animalcules, the same as on flies. I had now arrived at something definite; they were not the progeny of the fly, but animalcules floating in the air; and the quick motions of the flies gathered them on their bodies, and the flies then went into some quiet corner to have their dainty meal."

The investigator goes on to describe how he continued the experiment in a variety of localities, and how, in dirty and bad smelling quarters, he found the myriads of flies which existed there literally covered with animalcules, while other flies, captured in bed rooms or well ventilated, clean apartments, were miserably lean and entirely free from their prey. Wherever filth existed, evolving germs which might generate disease, there were the flies, covering themselves with the minute organisms and greedily devouring the same.

Mr. Emerson, while thus proving the utility of the fly, has added another and lower link to that curious and necessary chain of destruction which exists in animated nature. These infinitesimal animalcules form food for the flies, the flies for the spiders, the spiders for the birds, the birds for the quadrupeds, and so on up to the last of the series, serving the same purpose to man. He certainly deserves credit for an interesting and novel investigation, and for an intelligent discernment which might even attack the more difficult task of teaching us the uses—for Nature makes nothing without some beneficial end—of the animalcules themselves.

Fig 2.—THE HUDSON RIVER TUNNEL AT NEW YORK.—PROFILE CROSS SECTION

Vertical Scale, one hundred feet to one inch.—Horizontal Scale, four hundred feet to one inch.



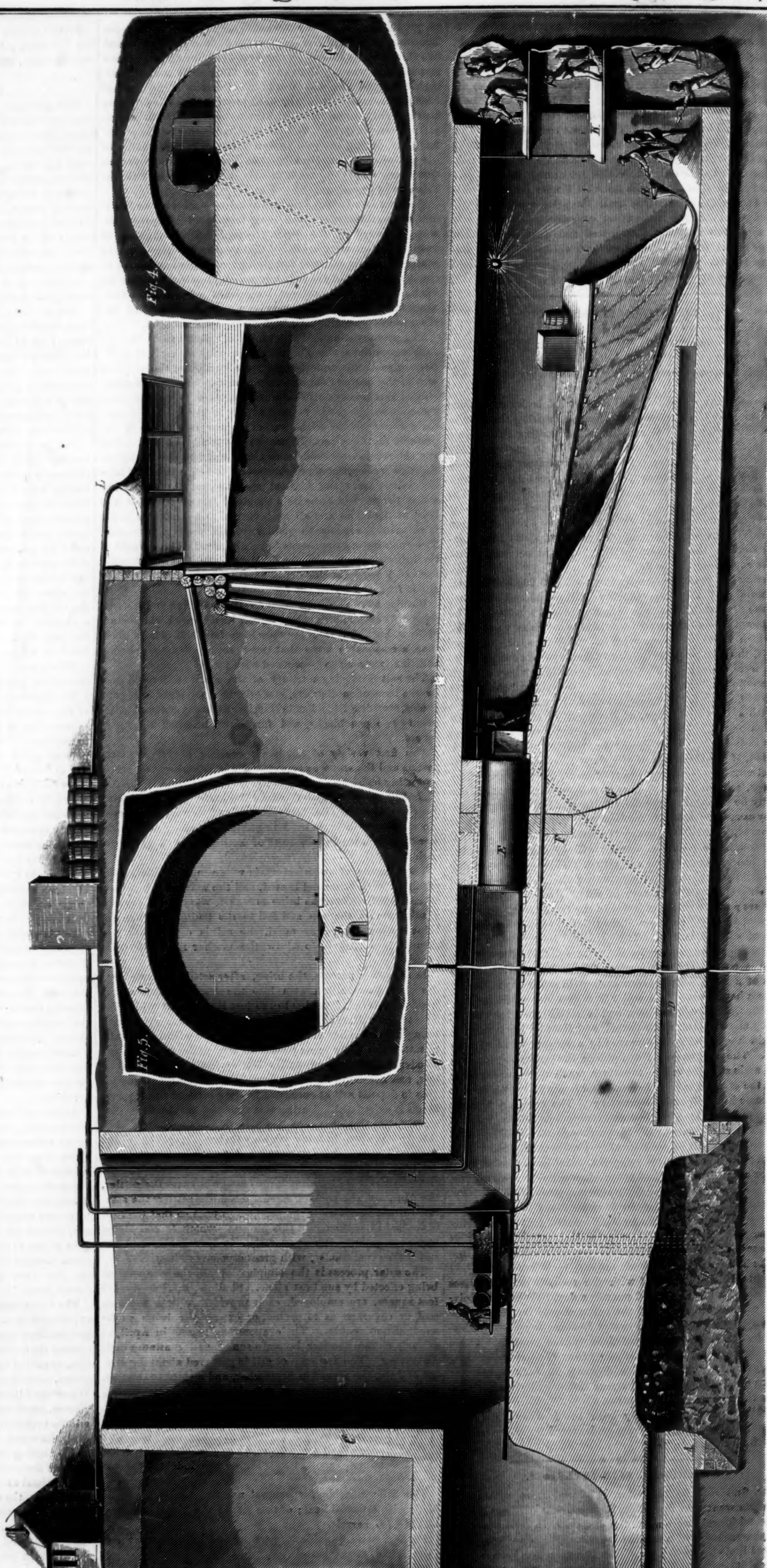


Fig. 3.—THE HUDSON RIVER TUNNEL AT NEW YORK.—SECTIONAL ELEVATION OF SHAFT, TUNNEL AND AIR LOCK.—Scale, 12 feet to 1 inch.

THE HUDSON RIVER TUNNEL AT NEW YORK.

We have heretofore made reference to the commencement of the great work of tunneling the Hudson river, for the purpose of establishing direct railway connection between the city of New York and the many great railways that now have their termini at Jersey City, upon the opposite bank of the stream. The gigantic traffic of all these railways at present depends upon ferry boats, the maintenance of which is expensive, while they are subject to frequent interruption. In winter, especially, when fogs and ice obstruct navigation, the ferry passage often involves the public in disastrous risks and inconveniences.

The project of tunneling the Hudson river at this point has been often proposed. Its importance as a promoter of the prosperity of New York city can hardly be overestimated. Every additional link in the chain of communications by which access to this metropolis is improved, rendered quicker, cheaper, or better, is a positive and permanent gain for the city. Every added facility for ingress and egress helps to swell its business, helps to increase both its resident and floating population, helps to build it up as the chief mart of commerce and finance of the New World. So obvious are the public benefits that must result from the building of great works like this that it seems hardly credible that it could have any real opponents. It is a serious fact, however, that there are individuals and corporations who are laboring against it. But we are confident they will not prevail. The work has been actually commenced, the means, it is alleged, are provided, and we believe the day is close at hand when railway cars will run under our Hudson with the same frequency and regularity as they now run under the Thames, at London.

This work of tunneling the Hudson is being carried on under the auspices of the Hudson Tunnel Company. Capital, $10,000,000. Incorporated under the General Laws of the States of New York and New Jersey. The President of the corporation is DeWitt C. Haskin; Vice-President, George G. French; secretary, L. C. Fowler, ; Consulting Engineer, William H. Paine.

Fig. 1 is a plan sketch of New York and vicinity, showing the general position of the new Tunnel. The other engravings are taken from the Company's drawings and works.

Fig. 2 is a cross section of the Hudson river, showing the Tunnel works in profile, the depths of soundings, borings, grades, and distances. The upper figures show the latter in hundreds of feet from the bulkhead lines. The intermediate figures indicate the depth of the water in feet. The lower figures give the depth of borings in feet. The extreme grade of the Tunnel is two in a hundred feet, descending from Jersey City, then, ascending on the New York side, three in a hundred for 1,500 feet, then two in a hundred to the New York end.

The greatest depth of water is a little over sixty feet. The borings show that the soil through which the Tunnel will pass is for the most part a tenacious silt, underlaid by hard sand. Near New York shore, a small extent of rock is encountered, and some gravel. The tenacious character of the soil is considered favorable for tunnel construction, and no serious difficulty of any kind is anticipated by the Company.

Fig. 3 shows a cross sectional elevation of the vertical shaft on the Jersey city side, lately begun, together with a portion of the intended horizontal Tunnel as it will appear when extended under the river.

Fig. 4 is a cross section of the Tunnel at the air lock.

Fig. 5, cross section of complete Tunnel and railway tracks.

The Tunnel walls, C', will be constructed of the best hard brick and cement, three feet in thickness; circular in form, twenty-six feet in width and twenty-four feet in hight, painted white in the inside, and lighted with gas; with a double track railway, with heavy steel rails, upon stone ballast five feet from the bottom. D, bottom drain.

The entrance to the tunnel on the Jersey side of the river is to be from Jersey avenue, on Fifteenth street; the work is to extend thence to Hudson street and the river, about 3,400 feet; thence under the river, curving five degrees northward, to the New York bulkhead line, at or near the foot of Morton street, about 5,400 feet; thence curving slightly southward in New York, about 3,000 feet, to a point to be selected by commissioners.

The entire length of the tunnel and approaches will be about 12,000 feet (with the depot tracks to be added thereto), being about one mile under the river, and nearly three fourths of a mile upon each side.

The track will be of steel, ballasted with broken stone to five feet from the bottom of the tunnel, where can be located gas pipes, pneumatic tubes, and water pipes, if needed. Telegraph wires can be placed upon either side.

For the purpose of expedition, it is proposed to work, from each side of the river at the same time, as many men as can be successfully employed in excavating and laying brick, changing them each eight hours. Thus by constant work, doing three days' labor every twenty-four hours—by which it is believed the work can be advanced five feet from each end every day—the whole work can very easily be completed within two years. The Hudson Tunnel Railroad Company will then be able to convey passengers, without change of cars, from the South and West, as well as from Newark, Elizabeth, Paterson, and all local points, arriving at Jersey City, and within six minutes thereafter to Broadway, New York, where the Company hopes to make connection with the Broadway Underground Railway, which is to run north and south.

The company say that more than four hundred trains of cars could be passed through the tunnel each twenty-four hours. Freight trains would have transit at night. Market trains in the early morning. All drawn by powerful engines, made especially for this purpose, to be run by signals—without bells or whistles—consuming their own steam and smoke, or run with compressed air.

All connecting railroads are to have an equal right to have their passengers and freight transported through the Tunnel upon the same equitable terms.

The construction of the Hudson Tunnel to a point near Broadway will soon involve the construction of another Tunnel under the East River to Brooklyn, from near the same point; then a perfect system of rapid transit railroads, running East, West, North, and South, would be in operation. This, the Company believes, is in the near future, and their report adds:

"Rapid transit should not be considered as useful in only one direction, but is equally useful to run East, West, South, and North—will be as well for New York, if extended to Brooklyn and Jersey, as to run into Westchester County. All will be benefited by the general prosperity of the main city itself. All are feeders to it. Thus all will derive their proportion of the benefits that their position entitles them to. This Tunnel the company justly regards as but the precursor to rapid transit in all directions, soon to follow.

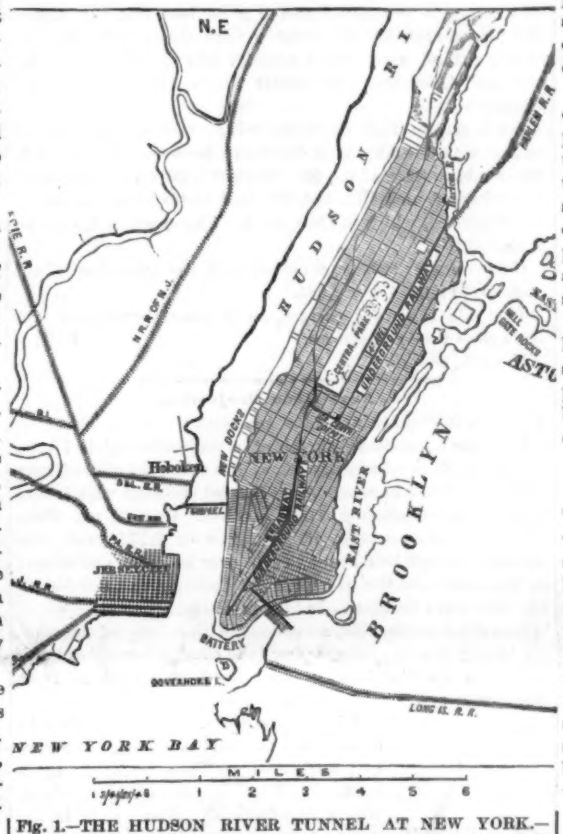


Fig. 1.—THE HUDSON RIVER TUNNEL AT NEW YORK.—PLAN OF THE CITY AND VICINITY, SHOWING THE LOCATION OF THE TUNNEL.

"The Tunnel was commenced in November last, after extensive borings, for a year previous, in the bottom of the Hudson river, down to the depth to be occupied by the tunnel. A circular working shaft, C, thirty feet in diameter and to be sixty-five feet in depth, was then commenced one hundred feet inland from the water, on Fifteenth street in Jersey City. After it had been sunk twenty feet, with perfected brick walls four feet in thickness, the further prosecution of the work was enjoined at the suit of the Delaware, Lackawanna, and Western Railroad Company. The litigation occasioned thereby, it is hoped, will be terminated soon, and the necessary legislation secured, when the work proposed will be resumed and forwarded as rapidly as possible."

The company further say "that the great expense of an undertaking of this magnitude has hitherto prevented its construction. The Hudson Tunnel Railroad Company, however, by the aid of compressed air, as applied in the patent therefor, obtained by its president, Mr. Haskin, in connection with other important appliances, will be able to complete this work at much less expense than any similar work has ever been constructed. It is believed that its present capital of ten million dollars will be abundant for that purpose. In its plan of construction no expensive coffer dam, caissons, or Brunel shields will be needed."

"The use of compressed air introduced into the face of the Tunnel, with sufficient pressure to hold in place, or keep back and prevent the interruption of silt, clay or water, will," it is believed by the company, "overcome the difficulties usually experienced in constructing tunnels, and also enable it by this agency, to remove the water and waste earth to the surface, through pipes, without the aid of hoisting apparatus."

The intended method of operating will be understood by reference to Fig. 3.

A is the foundation ring on which the masonry of the vertical shaft is built and allowed to settle as fast as the earth below the ring is excavated. At E, is an air lock, composed of an iron cylinder, with hinged doors at each end for access of men and materials. The cylinder is of small dimensions and rests upon a bed of earth and a wall, F, which, with a canvas curtain, G, and other packing, makes a sealed partition and forms a tight air chamber heading in front of the lock. A small railway track will convey bricks and materials to the heading. Air pipe, I, conducts compressed air from the surface to the heading. This air pressure is expected to assist in keeping out water and upholding the roof of earth during excavation in front of the masonry, also to supply air for the workmen, who will work in considerable numbers on platforms, K, as shown in our engraving.

The air pressure will also carry back up to the surface, through pipe, H, and discharge at L, into scows at the dock, all sand, mud, or water that may accumulate in the heading during the course of the excavation (H, Fig. 3).

We shall watch the progress of the work with great interest, giving our readers from time to time such incidents in connection therewith as may be desirable. We heartily wish success to the enterprise, and trust that it may be brought to the speedy completion that the company anticipates.

Backing for Photo Transparencies.

The *British Journal of Photography* says: To plain and rather thick collodion add some finely sifted carbonate of lead (white lead), in the proportion of a teaspoonful to four ounces of the collodion. Incorporate well together by trituration or shaking, then add a few drops of castor oil and as much Canadian balsam as would fill the half of a walnut shell. Filter through muslin, if necessary. This emulsion when poured upon glass will give a very fine and even opal surface; and glass thus prepared will, for the purpose under consideration, answer just as well as the finest and most expensive opal glass, whether flashed or pot metal.

Another opal mixture consists simply of a mixture of collodion and negative varnish. Although very pure and transparent when in the bottle, no sooner has a film been formed upon a cold plate of glass and allowed to become dry than the transparence gives way to a pure translucent white, presenting a very beautiful appearance. The mixture by means of which we made our finest specimens was composed in the proportion of an ounce of ordinary collodion to two drams of a retouching varnish, which we had made of sandarac dissolved in alcohol.

Let those of our readers who desire to examine and exhibit their transparencies under the most favorable circumstances at once remove the ground glass from them, supplying its place with a plain piece of glass rendered opaline by one or other of the methods described, and they will have every reason to be satisfied.

The Oxy-Sulphur Light.

We had a small sheet iron retort of the usual conical form. The delivery tube of this we loosely plugged to act as a safety valve, if necessary, and in the lid we drilled a hole and screwed four inches of quarter inch brass tube. Through a hole in the side of this was inserted a piece of much smaller tube, closed by hammering the end, and having the closing pierced by a fine hole. By this arrangement we had the larger tube in communication with the interior of the retort and in the center of that tube, and rising a little higher than the level of its mouth, a smaller tube coming out at the side and long enough to enable a rubber tube to be attached—an arrangement, in fact, very much like the ordinary form of blow-through oxyhydrogen burner. A quantity of sulphur was placed in the retort, and sufficient heat applied to raise the temperature to about 725° Fah. the point at which it vaporises. The end of the smaller tube was attached to the oxygen bag—one containing four cubic feet—and a fourteen pound weight applied, which was found amply sufficient. When the vapor of sulphur made its appearance, the oxygen was turned on, and the result was a steady flame of about two inches in length, and of such intensity that, although we had not an opportunity then of trying it, we are sure a small statuette could have been photographed by it in a few seconds.

The product of combustion—sulphurous acid—may easily be got rid of if there be in the room a suitable chimney; but even without that, there is no difficulty in rendering it so harmless that the operation may be carried on in a drawing room.

Beet Cider.

M. Plouard, a lawyer of Andelys, France, has invented a new cider, said to be very cheap and of excellent flavor—the peculiarity of which is that a large proportion of sugar beets is mixed with the apples before pressing; 80 lbs. of beets are mixed with 700 quarts of apples, or about 11 lbs. to 100 quarts. The beets and apples are pressed together, then saturated with water, left quiet in a cellar for twenty-four hours, and pressed anew. This is repeated seven times. The inventor says he makes 100 quarts of cider for 80 cents, which seems rather questionable.

The Latest Novelty in Paper.

Inasmuch as paper has been made available for the manufacture of almost every variety of furniture and articles of dress, it is passing strange that paper coffins should have been left till this late day unthought of. The undertaker is certainly not an enterprising party. Trunk makers have long been credited with using all the unsalable printed books; but at the present rate of production, were every traveler supplied with a van load of these troublesome *impedimenta* to traveling, such a stock would remain that all the bookshelves in the world would not contain a tithe of them. To further reduce the stock, a manufacturer out West proposes to supply every journeyer, to that bourne whence no traveler returns, with a last trunk made of *papier maché*, waterproofed with asphaltum.

M. SCHRETZ states that borax enfeebles the spontaneous movements of all living vegetable tissues and kills microscopic animalculæ. In this country, the use of borax as a preservative of wood has been patented.

Correspondence.

A Fossil Skeleton.

To the Editor of the Scientific American:

About three weeks ago, there was a report circulated in this vicinity that some men, while digging for water, had come across the skeleton of a most gigantic beast, the like of which had never before been found.

On hearing that the skeleton was on exhibition in this town, I went to see it. There were not many of the bones to be seen, but there were enough to give an idea of what the beast must have been.

The horn, which was the most conspicuous, I found to be eight feet nine inches in length and two feet one inch in circumference. It is slightly spiral and considerably curved in form tapering almost to a point; it is hollow for about four feet from the large end, which bears traces of having partly wasted away. There are three pieces of the jaw, one of which is two feet long and contains the two back molar teeth, and is one foot five inches from the joint to the first molar tooth. A similar piece of an ox jaw is about one half the whole length; so this,in the same proportion,would be about four feet long. This piece, which is of the lower jaw,is about six inches thick and eight deep. The largest of the teeth are seven inches long,and three and one half broad measured on the face. A joint of the back bone measured thirteen inches in breadth and twenty-one in hight; but it is broken on the upper end. The joint at the back of the head measured eighteen inches across. A bone, said to be the third short rib, is four feet five inches in length, and the bone from the knee to the ankle is seven inches across the top.

The horn in its present state weighs one hundred and five pounds,and one of the teeth weighs five and one half pounds. The bones are in a very good state of preservation, and also the horn; but the teeth (which are tubercular) are perfect, the enamel being as hard and intact as ever.

These remains were found in marshy land on the north shore of Lake Erie, eighteen inches underground; and over them there stood an oak tree three feet in diameter. There is more of the skeleton still under the surface,which will be taken out as soon as the frost is out of the ground.

Is this skeleton similar to that of a mastodon?

St. Catharine's, Ontario. A. R.

Kaolin in the United States.

To the Editor of the Scientific American:

Thirty-five miles from Omaha. Neb., there is a deposit of kaolin, about 30 feet thick and underlying about 100 acres. It crops along a bluff for over one half mile, with but a few inches of earth covering it. Beginning at the top, it is coarse and of a granulated nature; but as we descend, it grows finer, and is very fine and white near the bottom. It quarries in lumps,like chalk, and very readily dissolves in water.

Pure and free from foreign substances, it readily becomes pliable, and can be turned or molded into almost any form; and its shrinkage in drying is remarkably small. The difference of grades in fineness adapts it to the manufacture of a very large class of goods, such as are in demand throughout the West; and as it lies near the Burlington and Missouri Railroad, shipping facilities are convenient.

It makes a beautiful white brick, suitable for fronts and trimmings; and it seems well adopted for terra cotta, chimney tops, drain pipes, and all classes of jugs, crocks, etc., and is very superior for fire bricks.

This immense deposit, located as it is with timber, water, and all conveniences for manufacturing, offers, I think, a good opening for some capitalist to build up an immense business. I hope to see such a one take hold of and develop this material.

Omaha, Neb. J. M. GOODWIN

Setting Locomotive Valves.

To the Editor of the Scientific American:

In your issue of February 20, W. S. W. asks whether locomotive valves can be set without opening the valve chests? If the face of the valves and their seats are in good order, their adjustment may be determined with sufficient accuracy for all practical purposes by the issuing of steam from the water cocks in the bottom of the cylinders. This may be best done when there is but little pressure in the boiler, not quite enough to move the engine. Set the reverse lever to its extreme forward position, then open the water cocks and the throttle; then bar the engine forward, and, as the cranks approach their dead points, note carefully when the steam begins to issue from the water cocks. If the valves are correctly set, steam will begin to issue just before the cranks arrive at their dead points, owing to the lead of the valves. The amount of lead may be determined by placing a straight edge against the gland of the stuffing boxes of the valve stems, and marking (with a fine scratch awl) on the valve stem, just at the point wheresteam begins to issue, and then again just as the crank reaches its dead point; the distance between the scratches will of course indicate the amount of lead, and should not exceed one eighth of an inch for passenger engines, and less than one sixteenth of an inch for freight engines.

One revolution of the drivers is sufficient to examine each of the four dead points and adjust the lead and range of the valves, the range being adjusted by varying the length of the rods, of course, and the lead by moving the eccentric on the shaft, forward or back, as the case may be.

In setting valves as above explained, it is well to repeat the observation at each of the four dead points by moving the engine back sufficiently to take up the slack of the valve gear, and then bar it forward again and apply the straight edge as before.

To set the valves for the backward movement of an engine, the reverse lever must of course be placed at its extreme back position, and the engine must be moved backward instead of forward,otherwise the adjustment is of course precisely the same as for going ahead, except that all adjustment in the range of the valves must now be done by varying the length of the eccentric rods,because the least variation in the length of the valve stems would now upset the previous adjustment for going ahead.

Worcester, Mass. F. G. WOODWARD.

Method for Squaring Numbers.

To the Editor of the Scientific American:

In your issue of February 27, a correspondent gives a short method for squaring numbers ending with 5. There is an excellent rule for squaring any number; and by its aid the operation can be performed mentally on any number of not more than two figures. It is as follows:

Take the nearest number ending with a cipher to the number to be squared; if such number be greater than the one to be squared, subtract the difference between the two from the number to be squared, and if it be less add the difference; then multiply the number thus obtained by the one ending with 0, and to this product add the square of the aforesaid difference. The result will be the square of the numbers.

For example: Take the number 64. The nearest number ending with 0 is 60. The difference between the two is 4, which add to 64, making 68. Then 68×60,which can easily be performed mentally, is 4,080, to which add the square of the difference, which is 4×4 or 16. The result is 4,096, the square of 64.

If the number to be squared were 68, the operation would then be $(70 \times 66) + 2^2 = 4{,}624$.

This rule is always correct, easily remembered, and will often save time and figures. E. T.

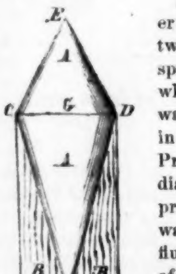
Newark, Ohio.

A New Rifle Projectile.

To the Editor of the Scientific American:

I enclose a sectional sketch of a projectile which I have invented. It is principally adapted to rifles. I believe I may safely say that I have made the longest shooting with it that was ever accomplished, *ceteris paribus*. Out of ten shots which I fired at a barn, at a distance of 2,773 yards, five passed through two boards, each over an inch and a half in thickness, and the sixth passed through the first board, and afterward became imbedded in a post.

I used a common rifle, an old one, without any of the modern improvements; judging from the circumstance that it originally had a flint lock, it must have been made at least forty years ago.



A is the projectile. B is a wooden cover in which the shot is placed. It serves two purposes: 1. That of filling up a space. 2. That of preventing windage, which it effectually does. C D is the waist. It comes, or was intended to come, in contact with the rifling of the cylinder. Proportions: C D=diameter, E G=1 diameter, F G=2 diameters. Were the projectile designed for a field piece the waist would be broader, and would be fluted for the purpose of receiving a band of softer metal. upon which studs would be placed.

Colonel Strange,R. A., Dominion (Canada) Inspector of Artillery, whose opinions on such matters are worthy of consideration, and who was one of the officers selected by the British Government to report on the artillery and arms of Prussia and France during the recent war,writes as follows:

J. Macdonald, Esq., London, Ont.:

Dear Sir:—I have to acknowledge the receipt of yours of January 8, 1875,inclosing description of a projectile proposed by you, and asking my opinion. 1. I am not surprised at its having an extremely long range. The form is exceedingly favorable not only to overcome resistance from air in front, but the projectile would be less retarded than those of the ordinary form (that is, with a flat base) by the vacuum formed behind the projectile when it moves with a velocity greater than the air can rush in behind it, which is a source of retardation at high velocities.

2. The center of gravity of your projectile is in about the right place, if the rifle had a quick twist; otherwise it would have a tendency to drop in front at extreme ranges.

The causes which led to the good shooting are probably:

a. The wood, having a lower specific gravity than the lead, was forced forward by the discharge and filled up the grooves of the rifle, imparting a twist and preventing windage. If you examine the bullets, you will find probably that not even the waist was cut by the grooves.

b. In the service artillery projectile, no part of the hard metal comes in contact with the gun.

c. The drawback to your system would be the difficulty of fixing a ring or studs of soft metal at the waist, which is and must be narrow to preserve your form.

d. The effect of field artillery depends on the shell power. Solid rifled artillery projectiles are obsolete. The space for powder in a common shell, on which its destructive power depends, is much diminished in your form of projectile.

e. Also the space for bullets in the Shrapnel shell.

I would not wish to discourage your researches, especially as you have hit on correct principles. Excuse haste and a candid reply.

T. B. STRANGE, Colonel,
Dominion Inspector of Artillery.

You are at liberty to make what use you like of this communication. J. MACDONALD.

London, Ontario.

Experiments with Honey.

To the Editor of the Scientific American:

On page 132 of your current volume, I noticed that one of your correspondents has great difficulty in preserving strained honey. Perhaps it would be of interest to him, as well as other readers of your valuable paper,to know that candied or crystalized honey can be permanently restored to transparency by the following method, which I have found successful: Take a flat bottomed pan, as deep as the bottles containing the honey, and fill it with cold water; place the bottles in it so as not to touch each other, put it on a slow fire, and heat it up to 212° Fah., and keep it at that heat until the honey is clear. Remove the pan from the fire, and you will have no further trouble with the honey.

Pittsburgh, Pa. A. L. F.

Tests of Vulcanized Rubber for Belts.

Chemical analysis, in the majority of cases, is powerless to determine the quality of vulcanized rubber, and the consumer is usually left to mechanical tests of the article furnished him, in comparison with other and similar products of known excellence, in order to find out whether the former is adapted to his purpose or attains a fixed standard of efficiency. These trials consist in examining the comparative degrees of elasticity and tenacity. The manner in which they are conducted in the French navy appears to us practical and easily followed. The first test consists in cutting from the sheets samples, which are left in a steam boiler under a pressure of 5 atmospheres for 48 hours. At the end of this time, the pieces should not have lost their elasticity. The specimens may then be placed on the grating of a valve box, under a pressure from above of 85·5 lbs. per square inch, and should withstand 9,100 strokes at the rate of 100 per minute. Specimens not boiled should withstand 17,100 strokes. Thongs of rubber boiled, and having a section 0·6 inch square and a length of 8 inches, fixed between supports and elongated 3·9 inches, should resist without breaking a further elongation of 8 inches, repeated 22 times a minute for 24 hours. Thongs not boiled, under the same conditions, should resist for 100 hours. These extra elongations may be easily made by a wheel, to the periphery of which one end of the thong is fastened, while the other extremity may be attached to a support. By turning the wheel, any determined elongation may be given at the rate of from 20 to 25 times per minute. Under the above conditions bands of first quality rubber, perfectly pure and well vulcanized, break after 180 or 200 elongations of 8 times the initial length. Bands cut from pure rubber, but of secondary quality, break after 50 or 60 elongations. Inferior caoutchouc, containing mineral matters or residue of old vulcanized rubber, gives no results at all.

M. Ogier (from whose valuable paper, recently read before the Paris Society of Civil Engineers, we extract the main facts of this article) has investigated the properties of rubber belts made of repeated layers of cloth covered with prepared rubber. Through the adhesive nature of the caoutchouc, the superposed tissues form, after vulcanization, a homogeneous substance, comparable, in M. Ogier's opinion, to the best curried leather. His experiments, in order to obtain the coefficient of friction of these belts on cast iron pulleys, give us results varying from 0·42 to 0·84, as against the coefficient for leather, 0·28. The minimum value corresponds to canvas and rubber belts without an exterior rubber coating. On pulleys of various forms, the maximum value of the coefficient of friction was found on those slightly convex and presenting a roughly turned surface, this result being inverse to that obtained with leather belts. Similarly the presence of fatty bodies has an opposite action on the cloth and rubber belts to that which it has on leather. On covering the former with a light varnish of half olive oil and half tallow, the adhesion was found to be considerably augmented. This fact M. Ogier, who does not counsel the use of the varnish but for rubber-coated belts, attributes to a resinification resulting from an action on the mixture of the excess of sulphur, which the caoutchouc always rejects after a certain period.

Experiments were also instituted on leather and rubber belts, in order to determine their resistance to rupture, and the law of elastic and permanent elongations obtained under increasing stress. These trials were made on belts 117 inches long, suspended from a crane by jaws, and carrying at their lower extremities other jaws which sustained the weight. Both pairs of jaws grasped the leather for a sufficient distance to preclude any possibility of slipping. The belts were allowed to remain under stress for an hour and a half before the elongations were measured. The results obtained may be summarized as follows: 1. The resistance to traction of rubber and canvas belts per square millimeter (0·0009 square inch) of section is at least equal to that of leather belts. 2. This resistance per square millimeter is independent of dimensions—length, breadth, or thickness. Such is not the case with leather belts, and therefore preference should be given to rubber belting whenever the conditions of the power to be transmitted necessitate the employment of very long, very wide, and very thick belts. 3. From two trials it appears that the external covering of caoutchouc adds nothing to the resistance, and hence it is advantageous to use covered belts which, at equal weights and prices, give a superior resistance. 4. Under the same weight the elastic elongation of leather belts is double that of rubber ones. The permanent elongation, under a change of 0·55 pound per square millimeter, reached 2 per cent in the former and nothing in the latter.

This last fact is worthy of special note, since the lack of success of rubber belting, in many cases, may be traced

thereby to the fact that a workman, used to leather belting, treats rubber naturally in the same way. He tightens the latter when it slips, a proceeding which results in breakage or rapid destruction through use at too high a tension. M. Ogier concludes that, in the present state of the leather and rubber industries, the price of installation, useful effect be ing considered, of leather and rubber belts is about the same, but the cost of maintenance of the latter is small when compared to that necessitated by the use of leather belts of large dimensions.

Electric Lathe Chuck.

In order to obviate the inconvenience and loss of time involved in the ordinary mode of fixing upon a lathe chuck certain special kinds of work, such as thin steel disks or small circular saws, the chuck is converted into a temporary magnet, so that the thin steel articles, when simply placed on the face of the chuck, are held there by the attraction of the magnet; and, when finished, can be readily detached by merely breaking the electric contact and demagnetizing the chuck. The face plate of the magnetic chuck is composed of a central core of soft iron, surrounded by an iron tube, the two being kept apart by an intermediate brass ring; and the tube and core are each surrounded by a coil of insulated copper wire, the ends of which are connected to two brass contact rings that encircle the case containing the entire electro-magnet thus formed. These rings are grooved, and receive the ends of a pair of metal springs connected with the terminal wires of an electric battery, whereby the chuck is converted into an electro-magnet capable of holding firmly on its face the article to be turned or ground. For holding articles of larger diameter, it is found more convenient to use an ordinary face plate, simply divided into halves by a thin brass strip across the center; a horseshoe magnet, consisting of a bent bar of soft iron, with a coil of copper wire round each leg, is fixed behind the face plate, each half of which is thus converted into one of the poles of the magnet. The whole is enclosed in a cylindrical brass casing, and two brass contact rings fixed round this casing are insulated by a ring of ebonite, and are connected with the two terminal wires of the magnet coils. A similar arrangement is also adapted for holding work upon the bed of a planing or drilling machine, in which case the brass contact rings are dispensed with, and any desired number of pairs of the electro-magnetic face plates are combined so as to form an extended surface large enough to carry large pieces of work. For exciting the electro-magnet, any ordinary battery that will produce a continuous current of electricity can be used; but in machine shops, where power can be obtained, it is more convenient to employ a magneto-electric machine—such as Gramme's, for instance—rather than a battery.

The Pyrophone.

At a recent meeting of the Society of Arts, London, a paper, descriptive of M. Kastner's new musical instrument, the pyrophone, was referred to. One of the instruments was in the room, and was experimented upon in the course of the evening. It was composed of a frame enclosing glass tubes, arranged in the form of the pipes of a small organ. In each of the tubes were two jets of gas, which were made to unite and separate by the action of keys, and thereby produced musical sounds. The paper, after describing the sound of the pyrophone, proceeded to explain the principles on which the sounds were produced. A very simple mechanism caused each key to communicate with the supply pipes of the flames in the glass tubes. On pressing the keys the flames separated, and the sound was produced; as soon as the fingers were removed from the keys, the flames joined, and the sound ceased immediately. If two flames of suitable size were introduced into a glass tube, and they were so disposed that they reached one third of the tube's hight, measured from the base, the flames would vibrate in unison. This phenomenon continued as long as the flames remained apart, but the sounds ceased as soon as the flames were united. The chairman, Lieut.-Col. Strange, said that this instrument was the invention of a young man who did not claim merit for it as a musical instrument, but as a scientific experiment, which, he hoped, would be of great value in the musical world.

The engraving of the pyrophone appeared in Vol. XXX, SCIENTIFIC AMERICAN, page 279.

The Morse Telegraph Alphabet.

At a recent meeting of the Scottish Society of Arts, Edinburgh, Dr. Russell, Demonstrator of Anatomy to the University, read a paper on "The Telegraphic Alphabet as a branch of Technical Education in Primary Schools."

In the course of his remarks, the lecturer explained the structure and uses of the Morse or telegraph alphabet, by means of a diagram, advocated its introduction into primary schools, and more especially into those situated along the coast. He then proceeded to mention some of the advantanges possessed by the alphabet as a means of communication. Among these were its extreme simplicity and the ease with which it could be learned by very young children; that it helped to prepare for post office employment and a seafaring life; that it was already known all over the world by experts; and that it could be used with or without any apparatus—an advantage which the lecturer believed was not possessed by any other method of signaling; that it involved no expense; that it formed a good alphabet for the blind; that it developed the sense of time or rhythm; and was important in relation to lighthouses. Dr. Russell further stated that the Morse alphabet had been introduced with marked success into Kilmodan Free Church School and South Hall Public School.

Glues and Cements.

The following article translated from *Des Ingenieurs Taschenbuch*, seems to contain, in a small space, a great deal of valuable information which will probably be acceptable to many of our readers.

GLUES.

1. COMMON GLUE.—The absolute strength of a well glued joint is:

	Pounds per square inch. Across the grain, end to end.	With the grain.
Beech	2 133	1,095
Elm	1,436	1,124
Oak	1,735	568
White wood	1,493	341
Maple	1,422	896

It is customary to use from one sixth to one tenth of the above values, to calculate the resistance which surfaces joined with glue can permanently sustain with safety.

2. WATERPROOF GLUE.—Boil eight parts of common glue with about thirty parts of water, until a strong solution is obtained; add four and a half parts of boiled linseed oil, and let the mixture boil two or three minutes, stirring it constantly. (In these directions, and in those that follow, parts by weight are to be taken).

CEMENTS.

1. WATERPROOF CEMENT FOR CAST IRON PIPES, ETC.—Take equal weights, in dry powder, of burnt lime, Roman cement, pipe clay, and loam, and knead the whole with about one sixth the weight of linseed oil. The addition of more Roman cement improves the quality.

2. CEMENT WHICH RESISTS MOISTURE AND HEAT BUT NOT THE DIRECT APPLICATION OF FIRE, FOR GAS AND STEAM PIPES AND SIMILAR PURPOSES.—Two parts of red lead, five parts of white lead, four parts of pipe clay; fine and dry, and work the whole into a stiff mass with boiled linseed oil.

3. RUST CEMENT FOR WATER AND STEAM PIPES, STEAM BOILERS, ETC.—Make a stiff paste with two parts sal ammoniac, thirty-five parts iron borings, one part sulphur, and water, and drive it into the joint with a chisel; or, to two parts of sal ammoniac and one part flowers of sulphur, add sixty parts of iron chips, and mix the whole with water to which one sixth part vinegar or a little sulphuric acid is added. Another cement is made by mixing one hundred parts of bright iron filings or fine chips or borings with one part powdered sal ammoniac, and moistening with urine; when thus prepared, force it into the joint. It will prove serviceable under the action of fire.

4. STOVE CEMENT, FOR THE JOINTS OF IRON STOVES.—Mica, together with finely sifted wood ashes, an equal quantity of finely powdered clay, and a little salt. When required for use, add enough water to make a stiff paste.

5. IRON CEMENT, WHICH IS UNAFFECTED BY RED HEAT.—Four parts iron filings, two parts clay, one part fragment of a Hessian crucible; reduce to the size of rape seed and mix together, working the whole into a stiff paste with a saturated solution of salt. A piece of fire brick can be used instead of the Hessian crucible.

6. CEMENT FOR FASTENING WOOD TO STONE.—Melt together four parts pitch and one part wax, and add four parts brick dust or chalk. It is to be warmed, for use, and applied thinly to the surfaces to be joined.

The Vicissitudes of the Sea.

The steamship Abbotsford recently arrived at New York, 108 days from Antwerp, during which the following mishaps occurred: On reaching one of the southern points of England, the ship stopped for a few minutes to land her pilot, and while so engaged was run into by another steamer, and so badly injured that the vessel had to go to London for repairs. Delay one month. The Abbotsford then continued her voyage to New York, but in mid-ocean, during a heavy gale, her propeller suddenly broke off. This converted her into a sailing vessel. The captain then put back to Queenstown, Ireland. On approaching land, a heavy gale blowing, he signalled for help from another steamer, which, in the effort to connect a hawser, dashed into the Abbotsford, knocking a hole forty feet long, happily above the water line. Through this aperture the water poured in whenever the vessel rolled, until the fore compartment was filled. But at last they reached Queenstown harbor; temporary repairs were made, and tugs employed which took the vessel to Liverpool. Here another month was consumed in repairs, and then another start for New York was made. Heavy gales were encountered, and the passage was long but successful.

Petroleum in Algiers.

A petroleum well, capable of giving a large and paying yield, has recently been discovered in Algiers, near the plain of Cheliff. The substance looks like tar, is soft and very tenaceous, melts in boiling water, and dissolves in turpentine. It burns with a very bright flame, and yields a large variety of products and considerable carbonaceous residue on distillation. It is neither tar, naphtha, bitumen, nor asphalt, but seems to possess the properties of all, in a measure. It has most characteristics in common with naphtha, but, unlike that substance, is almost completely insoluble in alcohol.

Honors to a Young American Lawyer.

The British Social Science Association has lately awarded its first prize of $1,000, for the best essay on international arbitration, to Mr. A. P. Sprague, of Troy, N. Y. Mr. Sprague is a young man of great promise and ability. The essay in question occupied 150 pages.

SCIENTIFIC AND PRACTICAL INFORMATION.

CURE FOR WARTS.

Lisfranc immerses the parts on which the warts are developed in a strong solution of black soap. This causes a slight cauterization of the surface of the wart. The loosened tissue is to be removed and the application repeated every day till the cure is complete. Oil of vitriol should never be used for this purpose; it is very irritating, and inflames the warts instead of curing them.

NEOGENE.

The above name is given by M. Sauvage to a new white alloy composed of copper 57 parts, zinc 27 parts, nickel 12 parts, tin 2 parts, aluminum 0·5 part, and bismuth 0·5 part. It has a silvery appearance, is sonorous, tenacious, malleable, and ductile, and is recommended for jewelry, as a substitute for silver in plate, and for low coinage. The new elements in the combination are those of the bismuth and aluminum. The alloy is very homogeneous, and is susceptible of a high polish.

A NEW SYSTEM OF DREDGING.

M. Bazin, of Angiers, France, proposes to attach, to a steamer with an engine of 60 horse power, two pipes on each side at some 12 feet below the water line. These pipes are to be 10 inches in diameter, about 50 feet in length, and are to be connected to the ship, so as to swing up or down, and also so as readily to yield to the movements of rolling, etc. The extremities of the couple on each side are united by tubes of like diameter, open at the forward end. In clearing out a quicksand, the vessel is got underway at the speed of 8 knots per hour; and on reaching the obstruction, the tubes are lowered with the soft mass. The water pressure above the sand or mud, which of itself would force the material into and up the tubes, is aided by the onward motion of the vessel, and the result is that the mud is driven through the tubes and into the hold. When the vessel is full, the apparatus is raised, and her contents hoisted out or otherwise discharged in some suitable locality. M. Bazin says that, with tubes of the size and with the speed above mentioned, 43,200 cubic feet of mud per hour could be raised. He points out that, in case of their becoming obstructed, the tubes can easily be cleared by simply elevating them out of the mass and allowing the water to rush through them.

Useful Recipes for the Shop, the Household, and the Farm.

The main objection most people have to sending communications on postal cards is that the writing is, of course, open to general perusal. A good way of avoiding this difficulty is to use sympathetic ink. A solution of 10 grains hyposulphite of soda in 16 teaspoonfuls water is the simplest fluid for the purpose. Use a perfectly clean pen, and after writing go over the letters with a smooth paper cutter to remove all traces of the salt. Exposure to the heat of a bright coal fire turns the writing black.

Soluble glass can be made of pure sand 15 parts, charcoal 1 part, and purified potash 10 parts. Mix and heat in a fireproof melting pot for five hours, or until the whole fuses uniformly. Take out the melted mass, and, when cold, powder it and dissolve it in boiling water.

To make pocket mucilage, boil one pound of the best white glue and strain very clear; boil also four ounces of isinglass, and mix the two together; place them in a water bath (glue kettle) with half a pound of white sugar, and evaporate till the liquid is quite thick, when it is to be poured into molds, dried and cut into pieces of convenient size. This immediately dissolves in water and fastens paper very firmly.

A solution of chloride of lime, in water to which a little acetic acid has been added, is among the many receipts recommended to remove ink stains from linen.

Marble can be stained different colors by the following substances: Blue, solution of litmus; green, wax colored with verdigris; yellow, tincture of gamboge or turmeric; red, tincture of alkanet or dragon's blood; crimson, alkanet in turpentine; flesh, wax tinged with turpentine; brown, tincture of logwood; gold, equal parts of verdigris, sal ammoniac, and sulphate of zinc in fine powder.

Mounting fluid for microscopic objects is made of gelatin 1 oz., honey 5 ozs., distilled water 5 ozs., rectified spirit ½ oz., and creosote 6 drops. Filter through fine flannel. Heat the honey before adding to the gelatin, which last must be dissolved in the boiling water. When cool, add the creosote.

Copies of signatures, which may be printed from on a copperplate press, can be made by writing the words and then sprinkling the wet ink with very finely pulverized gum arabic. Make a rim of dough, putty, or similar material, about the writing, and pour in melted fusible alloy of 5 parts bismuth, 3 lead, and 2 tin. This alloy melts at 199° Fah.

To bleach sponge, wash first in weak muriatic acid, then in cold water; soak in weak sulphuric acid, wash in water again, and finally rinse in rose water.

A very good imitation of meerschaum, which may be carved like the genuine article, can be made by peeling common potatoes and macerating them, in water acidulated with eight per cent sulphuric acid, for thirty-six hours. Dry on blotting paper, and for several days on plates of plaster of Paris in hot sand. The potatoes should be strongly compressed while drying.

NEW subscribers to the SCIENTIFIC AMERICAN will hereafter receive the papers from the time of our receiving the order, unless they specify some other date for commencing. All the back numbers from the commencement of the volume (January 1) may be had if requested at the time of sending the order, or on request, after receipt of first number.

IMPROVED WATER INJECTORS.

The value of the water injector is now widely known, especially for locomotive use, as it enables the engineer to fill the boiler while the engine is in the shed, and the water evaporated in the steam passed through the blower can be replaced before the engine is ready to start on its trip. The invention now under consideration is constructed in several forms, two of which we illustrate. Both of them are locomotive injectors, Fig. 1 showing a lifting injector, which is intended to pump the water as well as to force it into the boiler against a steam pressure, and Fig. 2 showing a form of apparatus to be used when the water flows from the tank at a higher level than the feed pipe of the boiler. Fig. 3 shows a non-lifting injector as applied to a stationary boiler. Fig. 4 shows Fig. 2 in section.

The new features in Mr. Friedmann's invention are the intermediate nozzle, shown in Fig. 4, which admits steam to the flow of water in two annular jets instead of one. This is claimed to prevent the recoil of the steam from contact with the water, as momentum in the water is continuous, owing to the jets being two in number. Another advantage in this arrangement is that the overflow from the first orifice flows down to the second, adjusting the water supply to the pressure of the steam. It is also claimed that this injector starts as promptly and works as well with steam of a high pressure as with that of a low pressure, and delivers more water with the same consumption of steam than injectors with movable nozzles, or other contrivances liable to get out of order, besides being more simple and easily manipulated. The intermediate nozzle of this injector being fixed and stationary, it is not liable to wear or need repairs.

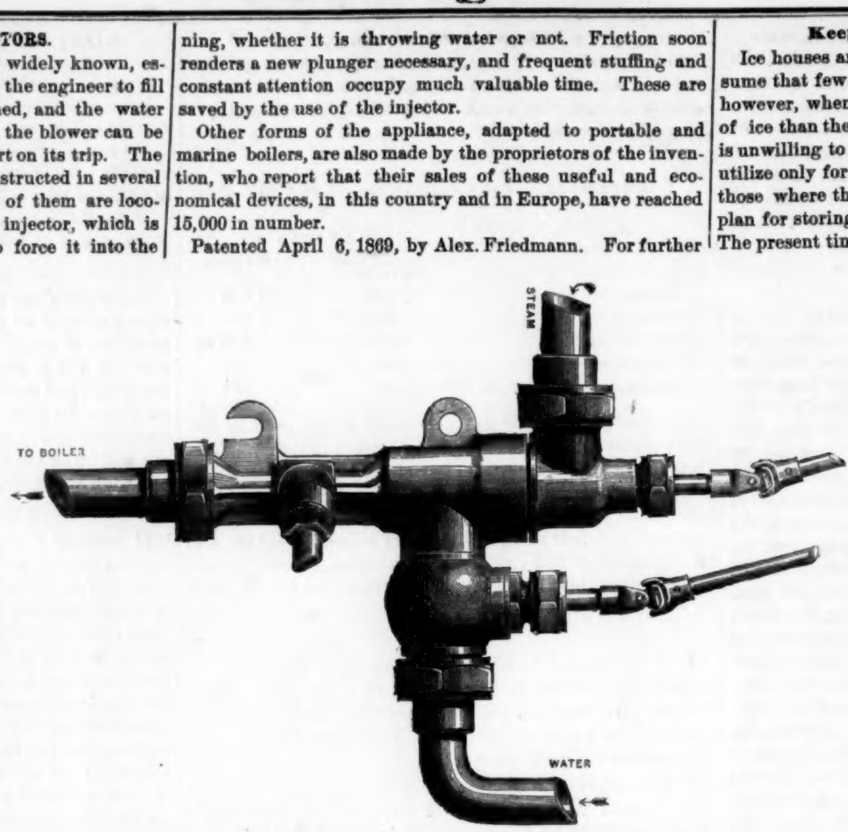


Fig. 1.—FRIEDMANN'S LIFTING WATER INJECTOR.

The lifting injector, Fig. 1, will raise water 6 or 8 feet with ease, and can be applied where want of space prevents the use of the non-lifting form, which must be placed below the water line. The latter, Fig. 2, can be used as a heating cock for the tender or water tank, by closing the overflow valve. The ordinary heating cocks are thus done away with, and the expense spared. The water in the tank can be heated by this means up to 120°, without any trouble in working or starting the injector. The overflow valve, with which each of these injectors is supplied, prevents air or dirt from entering the boiler. By simply transferring this valve from one side to the other, the injector may be used for either the right or left hand side of the engine.

Fig. 2.

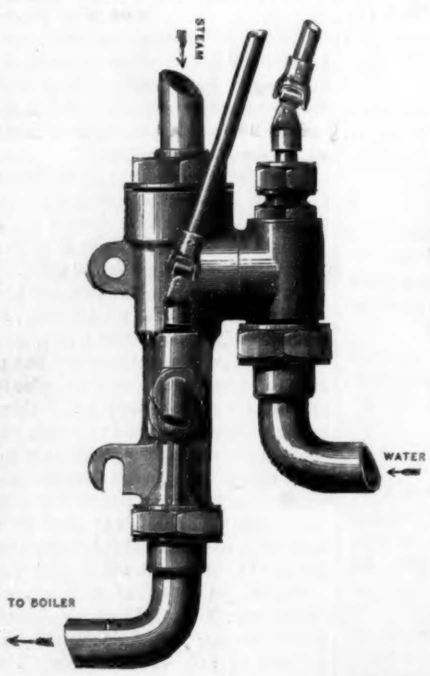
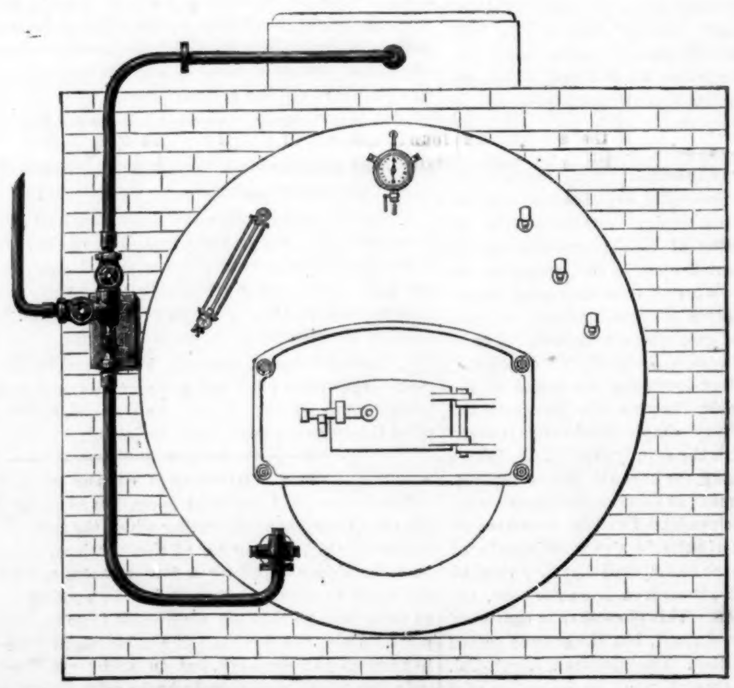


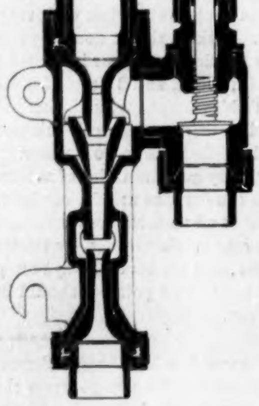
Fig. 3.



FRIEDMANN'S NON-LIFTING WATER INJECTOR.

The value of the injection system is very forcibly shown by its use on stationary boilers, which can be kept full when the engine is stopped for repairs. In a great many manufactories, hot water and steam are constantly needed for various processes, and the stoppage of an engine on which a boiler is dependent for its feed hinders the whole business. This, however, is obviated by the attachment of the non-lifting injector, as shown in Fig. 3. The injector is placed a little lower than the bottom of the heater or water reservoir, so that the water will flow to it by the action of gravity. The steam pipe should be attached to the top of the boiler, as shown, so as to secure dryness in the steam. The lifting form of injector is also adapted to stationary boilers.

Fig. 4.



On many locomotives, force pumps are altogether dispensed with, and two of these injectors are substituted on each engine. These are amply sufficient to keep the boiler supplied with water; and if one gives way the engine is not stopped. Another important point of economy is the wear and tear, as the force pump must keep moving while the engine is running, whether it is throwing water or not. Friction soon renders a new plunger necessary, and frequent stuffing and constant attention occupy much valuable time. These are saved by the use of the injector.

Other forms of the appliance, adapted to portable and marine boilers, are also made by the proprietors of the invention, who report that their sales of these useful and economical devices, in this country and in Europe, have reached 15,000 in number.

Patented April 6, 1869, by Alex. Friedmann. For further particulars address Messrs. Nathan & Dreyfus, 108 Liberty street, New York city.

A Tough Old House.

The Nashua (N. H.) *Telegraph* says: "There is an unoccupied house in Barnstead, Belknap county, having a chimney in the center. The house is 22 by 30 feet. The chimney is built so as to support the sills and beams. The frost has got into the cellar and frozen under the chimney and raised it up several inches, lifting the house free from the ground, except some nine feet where it touches the underpinning. In places it is two or three inches from the underpinning, and can be rocked by pushing against it with the hand. It has attracted a good deal of notice from the citizens of Barnstead."

We recommend the pattern of this house to dwellers in San Francisco and vicinity. A house that can be lifted by the chimney and rocked to and fro without danger would seem to be just the thing for all earthquake countries.

Paper as a Plant Protector.

A gentleman residing in Guernsey, Channel Islands, writes to say that he has saved his crop of early potatoes under glass by spreading newspapers over them, while his neighbors lost theirs by the severe frost. He suggests that a convenient number of newspapers be pasted together, and the edges folded over strings, thus making a screen which, suspended over the newspapers spread loosely over the plants, would give the young shoots an excellent protection in the severest cold weather, and from the sun's rays in summer.

AMONG recent curious inventions is the application of the camera obscura to a railroad car, imparting to the traveling and wondering beholder a moving diminutive picture of the country through which he is passing.

Keeping Ice without an Ice House.

Ice houses are not difficult structures to build, and we presume that few farms are without them. There are cases, however, when it is desirable to stow away a larger quantity of ice than the receptacle will contain, and when the farmer is unwilling to go to the expense of a house which he might utilize only for a single season. In such instances, as well as those where the ice house is absent altogether, the following plan for storing ice without an ice house will prove useful. The present time, we may here remark, should be taken advantage of at once to procure the ice, as the spring thaws now beginning will speedily cause the opening of the streams and ponds.

The first thing to be done in following the directions, which we find in the English *Gardener's Magazine*, is to select a shady spot, on the north side, if possible, of a clump of trees. Throw up a circular mound, some twelve inches in hight and at least fifteen feet in diameter, flattening the summit carefully, and leaving a trench around the eminence, two feet in width and eighteen inches in depth. In gathering the ice, there is no necessity of cutting into uniform shape or of seeking large pieces. Fill up the carts with any kind of fragments, transport them to the mound, and dump them on a platform made of a few planks. Ram the surface of the mound hard and firm, cover with sawdust, and then place the first layer of ice, which should previously be cracked into small pieces, for which purpose the men should be provided with wooden mallets. As each layer is put on the stack, the ice should be thoroughly pounded both above and at the sides so as to form a huge block of ice, the shape of which will be slightly conical.

When the stack is completed, it will require two coverings of straw, one lying upon the ice and the other supported on a wooden framework about eighteen inches outside the first covering.

The layer of straw next the ice must be well beaten and flattened down upon it, and when this is done be twelve inches in thickness. The framework, upon which a similar thickness of straw is placed, may be formed by inserting stout larch or other poles of a suitable length round the base in a slanting direction, so that they can be readily brought together at the top, and securely fastened with stout cord From six to eight of these will, when joined together by means of strips of wood fixed about twelve inches apart, afford ample support for the second covering of the straw. This must be put on nicely, so as to prevent the possibility of the rain's penetrating to the inner covering. By this arrangement there will be a body of air, which is one of the most effectual non-conductors known, between the two coverings of straw. To effect a change of the enclosed air, when rendered needful by its becoming charged with the moisture arising from the melted ice, a piece of iron or earthenware piping a few inches in diameter should be fixed near the apex, one end being just above the straw, and the other end reaching into the enclosed space. The pipe can be readily opened or stopped up, as may appear necessary, but as a rule it will suffice to open the pipe once a week, and allow it to remain open for about two hours. This should be done early in the morning, as the air is then much cooler than during the day or in the evening.

In removing ice from the stack, the early morning should be taken advantage of, because of the waste which must naturally ensue from a rush of warm air at midday. That removed can be placed in a cellar, or even an outhouse, and be enveloped in sawdust until required. The ice must be taken from the top; and when the first supply is obtained, a good quantity of dry sawdust should be placed over the crown. The principal points to avoid waste are to ventilate in the manner indicated, to avoid opening the stack more frequently than is really necessary, and to take the supply early in the day, before the air has been warmed by the sun.

ACCORDING to recent investigations by M. Cailletet, the results of burning sulphide of carbon, alcohol, and carburet of hydrogen, under pressures reaching thirty-five atmospheres, are that the flame augments considerably in brilliancy, while the combustibility of the substance burned is notably diminished.

Honing a Razor.

"The first requisite," says our correspondent G. W. D., "is to have a well shaped, well tempered and well (water) ground razor; unless very truly ground, it will be impossible to hone it properly. Take an Italian hone, of not too fine grit, face it perfectly with fine emery paper glued on a board; dust it off, and drop 6 or 8 drops of sperm oil on its face. Hold the razor perfectly flat on the stone, draw firmly but lightly from heel to point (from the further right hand corner to the lower left hand corner), against the edge; if a wire edge be produced, run the edge lightly across the thumb nail, and a few strokes on the hone will remove all trouble on that score. If you will examine the edge of the razor now, by aid of a magnifier, you will find that the fine grooves or teeth incline towards the heel.

I would here say that the hone must be kept perfectly clean, as, after using a few times and then neglecting it, the pores will get filled with steel, and in that case it will not be possible to get a keen edge on the razor. I have had a hone in use for forty years, for my own and friends' razors. I have kept it perfectly true, and yet there has been no perceptible wear.

I make my own straps as follows: I select a piece of satin. maple, or rose wood, 12 inches long, $1\frac{1}{4}$ inches wide, and $\frac{3}{8}$ inch thick; I allow $3\frac{1}{2}$ inches for length of handle. Half an inch from where the handle begins, I notch out the thickness of the leather so as to make it flush towards the end. I taper also the thickness of the leather; this precaution prevents the case from tearing up the leather in putting the strap in. I then round the wood very slightly, just enough (say $\frac{1}{12}$ of an inch) to keep from cutting by the razor in strapping and turning over the same. I now select a proper sized piece of fine French bookbinder's calfskin, cover with good wheat or rye paste, then lay the edge in the notch, and secure it in place with a small vise, proceed to rub it down firmly and as solid as possible with a tooth brush handle (always at hand or should be), and, after the whole is thoroughly dry, trim it neatly and make the case.

Use cold water for lather, as it softens beard and hardens the cuticle; hot water softens both and makes the face tender. Always dip the razor in hot water before using, and also after use, as it will dry it and prevent rusting."

RED DEER.

The deer family, species of which are indigenous to all countries in the world except Australia, are everywhere renowned for their graceful and elegant form and their timidity, their remarkable fleetness of foot enabling them, in open country, to keep away from the haunts of man. The race includes genera of all sizes from the little muntjac to the moose, and the chief peculiarities of the species, the horns, the hairy skin, the habit of rumination, and the feet, each with two principal and two rudimentary toes, are to be found in all of them. The American deer (*corvus Virginianus*) has a long head with a sharp muzzle, with large eyes; and the legs are long and slender. It is easily domesticated but requires a spacious range to keep it in health. The hind produces two or three young at a birth, but no *accouchement* takes place till she is two years old; she conceals her young carefully, visiting them only three times a day.

The subjects of our illustration are the red deer, formerly found in all parts of Great Britain, but now seen only in the mountains of Scotland and on one or two extensive moors. The red deer are so exclusive in their habits that they will not feed with inferior animals; they have an especial abhorrence for sheep, leaving the place at once if there are foot prints of sheep on the herbage.

The kind usually kept in parks in England is the fallow deer, a native of Africa originally; but it has been domesticated in England for some centuries. It is humbler in its tastes, and accommodates itself well to a small park or paddock. Like all its tribe, it sheds its horns annually, retiring as if in shame till the new growth appears.

Chemistry of Milk.

C. A. Cameron, M. D., states that the opacity and whiteness of milk are due, not to the liquid being an emulsion of fats, but to the reflection and refraction of light by solid caseous matter suspended in it.

COW'S MILK.—Forty analyses of pure milk from Dublin dairy cows gave the following average results: Water, 87·00, fats, 4·00, albumenoids, 4·10, sugar, 4·28, mineral matter, 0·62.

MARE'S MILK.—The average of the fourteen specimens gave: Water, 90·310, fats, 1·055, albumenoids 1·953, sugar, 6·285, mineral matter, 0·397. Mare's milk is bluish white; specific gravity about 1·031; reaction neutral, or faintly alkaline.

SOW'S MILK.—The sow parts with its milk (except to its young) with great reluctance. Its specific gravity is 1·041; its reaction faintly alkaline, and color yellowish white: 100 parts contain (mean of two analyses): Water 81·760, fats, 5·830, albumenoids, 6·180, sugar, 5·335, mineral matter, 0·895. These results show this species of milk to be very rich. It is remarkable that in the lactometer it shows up no cream. Drying on the water bath, it exhales the odor of roast pork, and on putrefying that of putrid bacon.

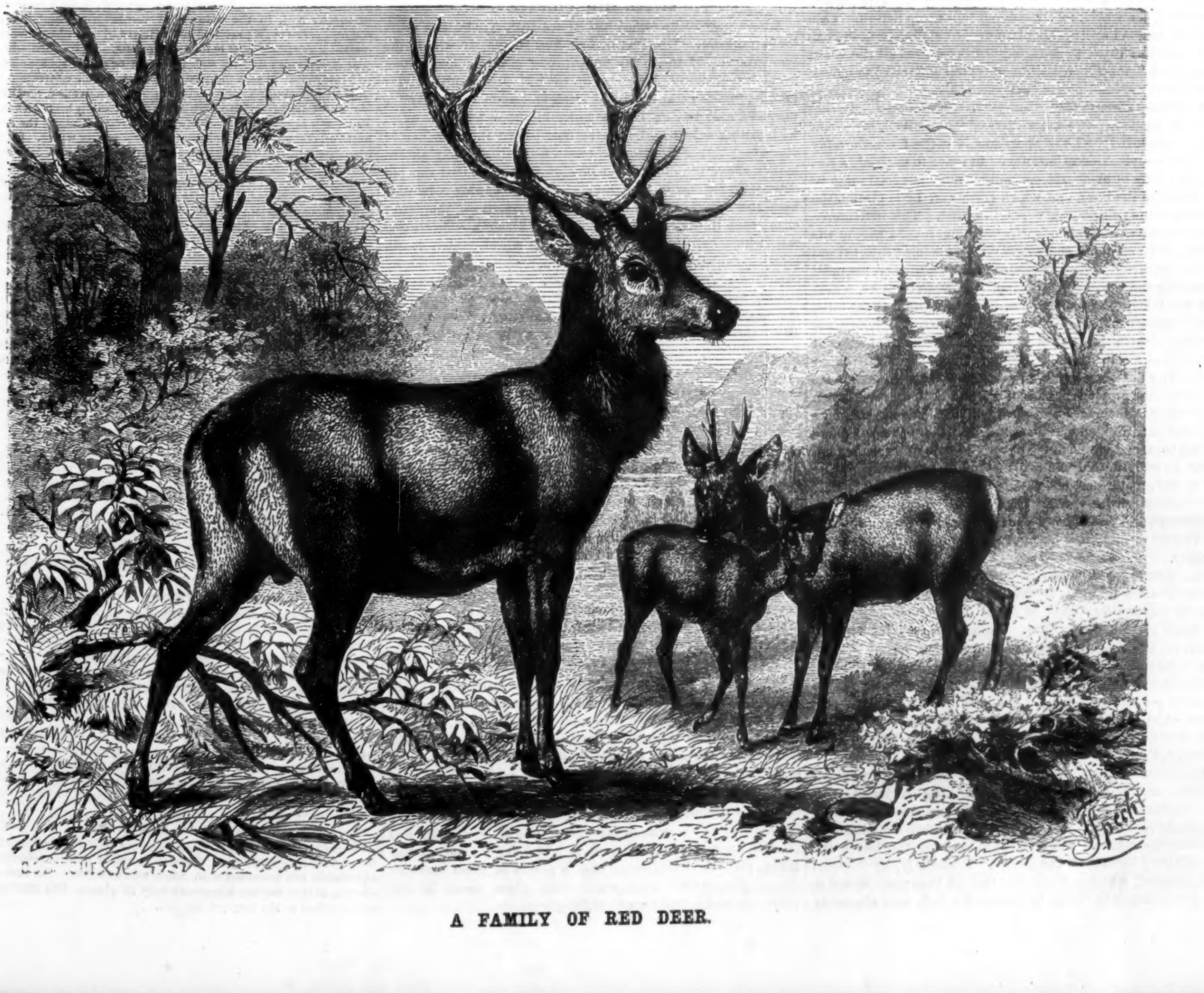
Salting, Packing, and Selling Butter.

Blanchard's *Butter Manual* recommends one ounce of salt to a pound of butter as sufficient for keeping it; but the better paying class of customers, who are a little more fastidious about the quality, prefer about one half as much; and this is found sufficient, if the casein has been properly removed. Butter makers in the vicinity of large towns should seek out regular customers for their produce, in which cases it may be put up in balls or any other form adapted to the demand. "Philadelphia prints," which have acquired a worldwide reputation, are pound balls, with a small figure upon the top They are usually enclosed in a white linen napkin, and packed in a cedar, zinc-lined chest, with apartments at each end for ice, to keep it hard while being transported to market For the great mass of butter makers, the wooden tub, holding from fifteen to one hundred pounds, must ever be the most economical form of package. In the vicinity of New York city, heavy return pails, of the best white oak, with thick covers, having the owner's name branded on them, are used and re-used year after year. In some parts of the West, miserably poor oaken tubs are employed, which affect the butter very injuriously. In other localities, ashen tubs are favorites, while in Northern Vermont the most approved tubs are spruce. Spruce is unquestionably the least liable of all timber to affect the flavor of butter injuriously; while it is generally believed that, for long keeping and much exposure, good white oak is preferable. Stone jars and crocks are sometimes used, but we do not recommend them. Much depends upon the purity of the salt—it must be perfectly white, and completely soluble in water. The office of salt is, first, to remove the buttermilk from the pores of the butter, and, secondly, to render harmless what cannot be removed.

A New Utilization of Refuse Materials.

A very important discovery has recently been made by MM. Croissant and Bretonniere, of Mulhouse, France, which consists in producing dyes of a large variety of brown hues from substances not merely refuse but in themselves colorless. The pigments are obtained by the reaction of alkaline sulphides upon ordinary wood sawdust, humus, horn, feathers, linen, silk, cotton, and paper waste, gluten, blood, and a number of other materials. In certain cases, when treated with the sulphides or polysulphides, the sulphur directly combines with the organic body; in others sulphuretted hydrogen becomes substituted for the hydrogen atoms eliminated.

The same body gives different shades, according to the degree of temperature, the duration of the operation, and the proportion of sulphide employed. The longer the heating and the higher the degree, the nearer the dye approaches to black. Humus gives a fine bistre shade, which does not fade and is unalterable by organic or mineral acids, caustic lyes, soap, oxalate of potassa, etc. With bran, a color is produced which subsequently, with bichromate, yields a fine brownish yellow or rosin color, which can be changed to gray by the addition of carbonate of soda. Sawdust, preferably of oak, chesnut, and other non-resinous woods, gives a soluble dye of a brownish black, which appears upon the fabric of a greenish hue. It is possessed of high coloring properties, and is very permanent.



A FAMILY OF RED DEER.

Phosphorus Steel Making.

M. F. Gautier, engineer of mines, France, gives the following useful sketch of the various methods for producing phosphorus steel, or, to use a more correct definition, phosphorus cast metal. This metal, says M. Gautier, cannot be employed in industry except on condition that it is nearly deprived of carbon, consequently every process which will yield extra soft steel will, with inferior materials, produce phosphorus cast metal.

I. THE BESSEMER PROCESS.—1. *The ferro-manganese process practised at Terre Noire.*—The silicious pig iron used contains but little manganese; the first stage, that which precedes the appearance of the yellow ray in the spectroscope, lasts about a quarter of an hour, according to the richness of the pig iron in silicon. There is no explosion, the flame is pure, without smoke; the completion of the operation is positively marked by the disappearance of all the rays of the spectroscope with the single exception of the yellow sodium ray. For the production of extra soft metal, the refining is prolonged for about twenty seconds, the blast is stopped, and the converter is laid on its side. Manganese iron, previously heated to redness, is then thrown in by means of shovels, taking care that the pieces pass through the scoria and enter the metal. The manganese iron used is an alloy containing a little carbon; the manganese in it reduces the oxide of iron in the converter, and the greater part of the carbon is converted into oxide of carbon in the form of brilliant flames. When the agitation ceases, the charge is drawn. The metal is even and quiet, without bubbles or other irregularities; and, which is of essential importance, the product is always equal and regular in practice. This is the method also which is adopted at the Seraing works, with the same manganese iron.

2. *Swedish method, with highly manganiferous pig iron.*—The pig iron used is without silicon, but rich in manganese, the proportion running from 4 to 5 per cent. The character of the operation is such that there is not what is called a first period; the yellow ray appears at once. There are abundant explosive projections, which would render the process ruinous if care were not taken to have enormous converters relative to the quantity of metal treated. The flame is veiled by smoke and gases, the principal of which is oxide of manganese. It is difficult to control the operation; for if the temperature be reduced by additions of small quantities of steel and iron, the object is not attained, for the heat must be retained in order to keep the metal in such extreme fluidity as will permit the oxide of iron to separate itself and arrive at the surface, for no addition is made of spiegel. The work is carried on blindfolded, for the intermittent flashes of flame are blinding; the heat caused by the explosions is annoying, and the spectroscope is misleading. From time to time samples of the scoria have to be drawn to find how matters are proceeding; after a certain amount of experience, the state of the metal is ascertained by the behavior of metallic globules under the hammer, and from the color of the scoria. But the results are uncertain, and have to be classified. The ingots, moreover, are liable to shrink and to become flawed. This mode is adopted at Fagersta, in Sweden; at Zwickau, in Saxony; and Maxhütte, in Bavaria; but it requires all the value that attaches to the production of extra soft steel to induce any one to continue a method so uncertain.

3. *English method, that of spiegeleisen by explosion.*—In this process, silicious pig, such as that of Cumberland, for example, is employed, and the operation is carried considerably beyond complete decarburation. In order to succeed, a certain quantity of oxide of iron, neither more nor less, must be produced in the bath, and which carries off by explosion the carbon of the spiegeleisen which is added. This instantaneous production of oxide of carbon is dangerous, a part of the metal, and sometimes the whole charge, being projected out of the converter, and endangering the operator and his men. Generally the product is soft, but it is liable to flaws, which are not much felt in sheet iron, but which unfit it for rails. Steel makers will choose whichever of these three methods appears to them the most advantageous for the production of phosphorus steel with pig iron of second quality. M. Gautier adds: The Bessemer process is destined to lose much of its importance in presence of the certain and unlimited extension of the Martin-Siemens process, which, he considers, will take the lead in future, and regulate prices. It is capable of using up old iron, and employing almost all kinds of ore, for puddling is still the only known method of practically getting rid of the greater part of the sulphur and phosphorus; while the Bessemer process, requiring silicious pig iron containing little sulphur, must always be of a limited application. The true mode of making phosphorus steel is then in the sole furnace.

II. THE MARTIN-SIEMENS PROCESS.—In this method the matter is more simple. In order to produce extra soft metal there is but one way, that is to say, to act chemically upon the oxide of iron in the bath. Manganese iron must be resorted to, as spiegel always gives hard products; the proportion is the same as in the Bessemer process, namely, 1 per cent of the whole, or about 2 per cent of manganese iron to 40 or 50 per cent of useful metal. When a sample is procured which bends perfectly when cold, the manganese alloy heated to redness is added, the bath is stirred slightly, and the charge run off.

An account, by M. Grüner, of the process followed at Zwickau and Maxhütte, supplies a striking confirmation of the fundamental properties of phosphorus steel; you may introduce phosphorus into cast steel on condition of eliminating the carbon, and the less the amount of the latter the greater may be that of the former. Practically, by the German method, which is really but that of Fagersta applied to less pure materials, metal is produced which may almost be said to be without carbon, and, as no spiegel is introduced, there is no element of recarburation. It is not, then, astonishing that the metal thus obtained should be perfectly malleable and yet contain a notable proportion of phosphorus, that is to say, half the quantity which may be tolerated in a truly soft steel, when produced in a Martins Siemens furnace with manganese iron

Having a Hobby.

The question "is there money in it?" is said by some men to be the test by which everything is to be received or rejected. And those who offer this very mercenary gage claim to be the only "practical" men, and the true prophets for these times, and indeed for all times. The science of getting, the art of keeping, and the process of increasing are deemed by them to include all that is useful in the circle of sciences, the field of art, and the aims of thought. Most people concede in the abstract these pretensions of the mercenary philosophers, though the great majority in practice are better than their theory.

The maxim, roughly expressed, that "everybody should have a hobby," is a good one, provided that the "hobby" one rides should be a mental rather than a sensual one. It should carry the rider over the route of mental improvement to the development of his reasoning and analytical powers, and thus promote the growth of the attributes which distinguish him from the brutal and ally him to the divine. To go back to the question alluded to above, in regard to education, the first question asked may very well be: "Is there money in it?" But if this be the last question as well as the first, and the sole object of learning be mercenary, the seeker will find relief in bodily excesses, from his mental discipline. Or, classing drudgery of the mind with drudgery of the body, he will look for enjoyment where the intellect may be laid aside, like the tool of the artisan or the ledger of the merchant.

It was well said in a recent address to young men, in the evening classes of the City of London College, that "they must extend their mental horizon by raising the level of their sight; that they had to adorn their lives as well as to sustain them; and that they had not only to be tradesmen but men." The speaker told them that they must not only pursue their technical studies, but, as a relief and recreation, follow themes calculated to raise the tone of their minds and carry them beyond the routine of their daily lives. He said that they had not only to live but to enjoy their lives. He recommended them to take up one subject, "to which they could devote themselves with such enthusiasm that it would become a pleasure and a relaxation." To a man immersed in any business pursuit, it is highly desirable that he should change the current of his thoughts and prevent his whole existence from being confined to one routine, which, without such relief, must inevitably dwarf his intellect and weary his body.—*Philadelphia Ledger.*

Steam Hill Climber.

A new locomotive for use on Ithaca Hill, N. Y., has made its appearance. The incline has five tracks, of which the two outer are of the usual width, used in the ordinary manner. When the engine starts up the hill, it rests upon a pair of rails just within the usual track and upon a set of double flanged small driving wheels which are upon the same axles with the big drivers—they being only about thirty inches in diameter; this inside track is raised about fifteen to eighteen inches above the outer one, and high enough so that the big drivers do not touch the track at all; the engine rests now upon the small drivers, and is independent of the outer ones; then in the center of the track is placed a wide cogged rail, which exactly meshes into the cog wheel which is between these small drivers, directly under the center of the locomotive. Thus it will be seen that, by applying power to the big drivers, in the ordinary way, the power is applied to the cogged wheel, which does the climbing. The cogs are about three inches from tip to tip, and the wheel is eight inches wide.

Bright Deep Blue on Wool.

The following is said to yield a tolerably fast color, of desirable luster, similar to that of dark vat blue: The wool or cloth is prepared by boiling for an hour in a hot kettle, with $2\frac{1}{2}$ lbs. alum, $\frac{3}{4}$ lb. chromate of potash, $1\frac{1}{2}$ lbs. sulphuric acid, and 2 ozs. tin salt in solution, for 40 lbs. of material. It is then opened out and well cooled, and allowed to lie for 12 hours. The day after, 8 lbs. of logwood are boiled in a fresh bath, and then 3 ozs. of aniline violet (the bluish, soluble in water) are added, and, as soon as it is dissolved, another $\frac{1}{2}$ lb. of sulphuric acid. The prepared articles, after being washed or rinsed, are placed in the bath at 122°, and, after half an hour, are worked at a boil for an hour. More aniline violet affords a stronger blue, more logwood a deeper blue. The color can easily be cleaned in cold water.

PRODUCTION OF OZONE.—Ozone may be easily and abundantly generated in any apartment by means of an aqueous solution of permanganate of potash and oxalic acid. A very small quantity of these salts, placed in an open porcelain dish, is all that is necessary, the water being renewed occasionally as it evaporates. Metallic vessels should not be used.

AT the Edinburgh Literary Institute, Professor Geikie stated it to be his opinion that his colleague, McCroall, had pitched upon the precise epoch in which the glacial era had taken place, and attributed it to a period of great eccentricity of the earth's orbit, which took place about 240,000 years ago and lasted about 160,000 years.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From February 2 to February 25, 1875, inclusive.

AXLE.—S. L. Harrison, San Francisco, Cal.
BALANCED SLIDE VALVE.—E. T. Smythe, New York city.
BEVEL, SQUARE, RULE, ETC.—W. Ascough, Buffalo, N. Y.
BOILER FURNACE.—H. A. Studwell, Brooklyn, N. Y.
BUSTLE, ETC.—A. W. Thomas, Philadelphia, Pa.
CAR SPRING.—G. Godley, New York city.
FERTILIZER.—B. Ackerman, New York city.
FILLING BOTTLES, ETC.—J. B. Bradford, Boston, Mass., *et al.*
FILTER.—J. Outerson *et al.*, Windsor Locks, Conn.
FREEZING, CHURNING, ETC.—W. Redheffer, St. Louis, Mo.
FURNACE GRATE.—J. B. Larkin, Pittsburgh, Pa.
HARVESTER.—D. M. Osborne, Auburn, N. Y.
HORSE SHOE NAIL.—J. R. Heard, Boston, Mass.
IMITATION LEATHER, ETC.—C. H. Knelles, New York city.
LOOM HEALD.—H. O. Whipple, New York city.
MOTIVE POWER ENGINE.—G. Westinghouse, Jr., Pittsburgh, Pa.
MULTIPLEX TELEGRAPH, ETC.—T. A. Edison, Newark, N. J.
NEEDLE.—W. Trabue, Louisville, Ky.
ORDNANCE.—G. H. Felt, New York city.
OVERALLS.—H. F. Woodward, New York city.
PATCHING BULLETS.—H. Borchardt, New Haven, Conn.
PORTABLE LATHE.—F. Scott, Bennington, Vt.
PRISM.—J. W. Queen & Co., New York city.
ROCK DRILL.—E. S. Winchester, Boston, Mass., *et al.*
RUBBER BOOT AND LAST.—I. F. Williams, Bristol, R. I.
SCREW PROPELLER.—A. C. Fletcher, New York city.
SHEARING SHEEP, ETC.—E. Chaquette, San Francisco, Cal.
STEAM ENGINE.—A. S. Cameron (of New York city), London, England.
STEP SURFACE.—G. A. Keene, Lynn, Mass., *et al.*
TREADLE APPARATUS.—G. D. Dows, Boston, Mass.

Recent American and Foreign Patents.

Improved Washing Machine.

Silas W. Holbrook, Catskill, N. Y.—The invention relates to an arrangement of yielding plates forming the continuous inner wall of the suds box, and being free to move at each end between parallel guide blocks. The clothes are put into the space between the ribbed spring plates and a ribbed cylinder, and are carried around through said space by the revolution of the said cylinder, and are washed clean by being rubbed against said plates, and by being carried around through the water.

Improved Seat for Extension Carriages.

James V. Randall, Newtown, Pa.—The rear seat is made adjustable toward or from the front of the carriage, and the elastic front seat is pivoted and supported, so that the weight of the person or persons sitting upon it will spring its center down slightly, which tends to throw the lower ends of the standards outward, and thus holds the gudgeons securely in their sockets.

Improved Lamp Burner.

Walter McKinley, Tremont, Ohio.—The object of this invention is to provide a lamp burner of improved construction, which shall be simple and detachable in all its parts, and, in consequence of the same, more convenient to clean and easy to keep in repair. It consists in a burner cap provided with a groove, in combination with a detachable wick tube, a detachable set of spur wheels for adjusting the wick, and a detachable shaft for operating said wheels. It also consists in the peculiar construction of the spur wheels, and in the manner of fastening the devices together.

Improved Ditching Machine.

Senator Theodore F. Randolph, Morristown, N. J.—Ex-Governor Randolph has for some time past been engaged in developing the novel form of ditching machine which forms the subject of this patent. The device now completed presents many excellent points of merit, and, in the opinion of the inventor and many of his friends, is the most practical and efficient of the many machines for ditching purposes now before the public. Its construction is such that it will work equally well in clayey or sticky soils and in sandy or loose soils. It may be readily adjusted and controlled, so as to sink a vertical ditch upon inclined or uneven ground, and the ditching wheel may be readily fed down as the ditch increases in depth. There is a novel combination of parts for adjusting the angle and hight of the shoe with relation to the ditching wheel. By suitable construction, the wheel and frame can be raised and lowered without affecting the axle, and the axle can take any inclination the surface of the ground may require without affecting the ditching wheel and its frame. The rear axle may be inclined in either direction to accommodate it to the surface of the ground. The edges of the flanges of the ditching wheel are made sharp, so that they may be sunk into the soil at the bottom of the ditch by the weight of the wheel and frame, so as to separate the sides of the slice of soil to be raised from the sides of the ditch. As the soil passes over the top of the wheel it is delivered into a chute, by which it is discharged upon the side of the ditch, and which is provided with a tongue, which enters the channel of the wheel and serves as a scraper to disengage the soil from said channel. The frame and ditching wheel may be held in a vertical position, while the axle is inclined in either direction by its wheels in passing over uneven or inclined ground. By this construction, all the necessary adjustments can be made without stopping the machine. Knives shave off the sides of the last previous cut to widen the ditch, and enable the ditching wheel to work freely and without binding.

Improved Sheep Holder for Shearing.

Joseph R. Virgo, Texas, Mich.—This consists in an adjustable shearing table, having an adjustable stand and plates for holding the legs of the sheep. When a sheep is fastened on the table, it is in an easy position and convenient for the shearer, and can be turned by turning the table to the right or left, as may be required.

Improved Fifth Wheel for Vehicles.

George F. Putman, Fonda, N. Y.—The head block or axle is provided with guard plates at both sides and opposite points of the fifth wheel, for protecting king bolt and wheel.

Improved Parlor Fountain.

Herman Wenzel, New York city.—Air is forced by the upward pressure of water in the base through a pipe, over the water in a chamber below, and, by its compressive force, ejects the liquid through the nozzle. A pump operated by a treadle is arranged within the base, and connected with the lower chamber of the basin by a pipe, so as to enable the water in the base to be forced into the lower chamber of the basin, and kept there in full supply.

Improved Combined Fluting and Sad Iron.

Charles Raymond Rand, San Francisco, Cal.—This invention relates to an improved fluting and sad iron which is heated internally with gasoline or other volatile distillate of petroleum. It may be readily used on different sides, either as a sad iron or for fluting. A detailed illustrated description will be found on p. 150 of our current volume.

Improved Bridle Bit.

Peter Casey, Newport, R. I.—Side pieces pass through mortises in the ends of a movable bar. The side pieces, in order to render them adjustable, are provided with holes, which receive the ends of set screws, so that the bar is securely held in place. The driving lines are attached to the loops of the bar.

Improved Wagon Jack.

Samuel Chard, Mianus, Conn.—This invention consists in a cramping band and pillar, with a hoisting lever having a fulcrum pin and holding hook. The long end of the lever being depressed, the weight will be thrown upon the fulcrum pin, which will cramp the band on the stand and prevent it from slipping.

Improved Range.

Edwin O. Brinckerhoff, New York city.—The arrangement of the flues in this range is such that it may be thoroughly and uniformly heated for baking purposes, that it may be used for boiling purposes without being wholly heated, may have a strong draft, and may be easily manipulated to control the heat.

Improved Saw Mill.

Charles Lindner, Hockley, Tex.—The intermediate wheel for running the carriage back is mounted on the lever, which is pivoted to a fixed pivot, so as to have a little end motion. It is connected at the other end by a link to lever, in which the shaft is journaled, and which is so pivoted that, whenever said lever is shifted to gear the feed, it throws out the running back gear; and when it is shifted so as to gear the running back train, it throws out the feed.

Improved Shoe Blacking Case.

William H. Morse, East New York, N. Y.—A foot-rest bar rests in notches in the inner sides of the box, and is kept from rising by a plate or tenon, which enters a groove. In a block which fits in the box is a round hole to receive the box of blacking, which is secured in place by a curved spring. The cover is supported, when turned down, by a wide cleat, which, with another cleat, serve as handles for lifting and carrying the case.

Improved Hay Gatherer.

Chesley Thomas Noell, Clarksville, Mo., assignor to himself and Uriel Griffith, of same place.—This invention consists in a toothed rake provided with pulleys to which the traces or draft appliances are connected. When the load of hay has been drawn to the place of stacking, the rake may then be drawn from beneath the hay and another load gathered.

Improved Fanning Mill.

Asa Y. Felton, Plain View, Minn.—The sieve is of sheet metal, the perforations being of the same size and farther apart in the upper portion, where the grain is received on it, than in the lower portion. This causes a larger portion to slide along the sieve before falling through, and spreads the falling grain more evenly throughout the area of the sieve, so that the air will act to better advantage. The sieve supports are shifted up and down in the side boards of the shaker, and fastened at any point to hold the sieves in the proper descent by slide bolts.

Improved Die for Making Chain Swivels.

Philander H. Standish, Jefferson City, Mo., assignor to himself and J. H. Bodine, of same place.—When the link blank and eye piece are put in their places in the dies, and pressed together, the overlapping ends of the link blank will be folded around the neck of the eye and welded together, and at the same time be shaped and finished in regard to form by one or two blows of the dies. The prongs of the eye piece are then heated and bent up, shaped, and welded in any approved way.

Improved Wheel Cultivator.

George S. Brower, George W. Brower, and Edwin A. Brower, Crawfordsville, Ind.—Devices are provided to swing the inside plows laterally to the row, for regulating them to the curvatures, and to correct the effect of irregular driving; and to so shift the plows, hangers are connected to cranked foot levers, which are to be worked by the driver's feet as he rides in the seat.

Improved Velocipede.

Walter Knight, San Andreas, Cal.—The feet rest on supports during the revolving of the front crank axle by the hands, and turn a lever and therewith turn the wheel to either side for guiding and steering the perambulator. The steady hold which is exercised by the simultaneous action of the feet on the fulcrum lever keeps the steering wheel in any desired position, so that the carriage may be easily guided in the required direction.

Improved Churn.

August Meyer, Port Washington, Wis.—In the cover is formed an air hole, in which is inserted a tube, to the upper end of which is attached a knob. The base of the knob is made of a larger diameter than the tube, so as to prevent the said tube from dropping through the cover. The lower end of the tube is flanged with stops, to prevent it from being drawn out of said cover. The lower end of the tube is open, and in the sides of its upper part are formed holes, so that, when the said tube is drawn up, the air may pass out and in freely, and when the said tube is pushed down the passage of air may be prevented. The milk is prevented from spattering into the tube by a guard plate.

Improved Draft Equalizer.

Edwin A. Beers, De Kalb, Ill.—By this invention, the draft of three horses, when used abreast, is equalized. A rod is attached to the front of the wagon, and the tongue is attached to the rod by braces. These braces have eyes which slide on the rod, and the tongue may be adjusted in any desired position by means of collars, in which are set screws. The evener is attached to the tongue at a point about one third of the length of the evener. A single whiffletree is provided for the right-hand horse. A lever is fastened by a joint through its end to the end of the evener, and a chain is attached to the lever at a point about one fourth the length of the lever from the loose end. This chain is attached to the rod by an adjustable slide. A whiffletree is attached to the loose end of the lever for the middle horse. A band is attached to the under side of the evener, and surrounds the lever and limits its action back and forth. Lastly, a whiffletree is attached to the evener for the outside horse.

Improved Window Ventilator.

Samuel W. Couch, Cold Spring, N. Y.—Two sets of plates are placed directly over the top bar of the upper sash, and the top bar of said sash is grooved upon its upper side to such a depth as to receive the plates when they are closed up. With this construction, when the upper sash is lowered, the plates descend with it or open out, and when the said sash is raised they are closed up and inclosed in the groove of the upper sash bar, so as to be entirely out of sight. The air passes in and out through the spaces between the plates.

Improved Spring Bed Bottom.

Joseph Fowler, New York city, and John R. Dewar, Bergen, N. J.—This improvement relates to connecting the slats of the bed bottom in pairs or sections, and also preventing endwise movement of the same, by means of notched blocks, which engage or lock with the springs that support the bed.

Improved Music Leaf Turner.

William H. King, Petersburgh, Ind., assignor to himself and Jerome Borer, of same place.—This is an attachment consisting of a cord fastened by a hook and elastic strap to the left side of the music rack, to be wound around the knob of the music leaf turner. It passes then over suitable pulleys to a lever pivoted to the under side of the piano, the front part of which is acted upon by a hinged plate with segmental ratchet, and operated by the leg or foot, turning the leaves, on raising the ratchet plate, by means of the elastic strap in one direction, and by means of the lever in opposite direction.

Improved Pawl and Ratchet.

Ralph Tomlinson and Joseph Smith, Boston, Mass.—The pulley is loose on the shaft, the ratchet is keyed to it, and the pawl is fixed on a pivot at or about the middle, and has a projection with relation to which and the pivot of the pawl the spring is so arranged that it will hold the pawl either in or out of connection with the ratchet, according to which way it is shifted.

Improved Revolving Spice Box.

Thomas W. F. Smitten, New York city.—This consists of two or more upright cases, with perforated tops for pepper and other condiments, pivoted on the vertical spindle of a stand, to swing horizontally around it. There are as many imperforated covers as there are cases, less one, so contrived that, the one case to be used being shifted to the place where it is uncovered, the others will, by the same operation, be brought under cover, so that the holes will be closed in all except the one to be used.

Improved Whip Tip Ferrule.

Edward B. Light, Denver, Col.—A short solid cylinder is fitted into the center of the ferrule, and secured there by a pin. A rod passes longitudinally through the center of the cylinder, and is rigidly secured. Upon each end of the rod is cut a screw thread. In using the device, the butt end of the tip is screwed into the ferrule until it strikes the end of the cylinder. The small end of the whip stock is afterward screwed into the other end of the ferrule until it strikes against the end of the cylinder. By different sizes of ferrules, a whip, when broken, can be cut into at the break and conveniently repaired, without the use of any tool.

Improved Level.

Christian C. Schwaner, Winterset, Iowa.—The case is made hollow, with a slot in the middle part and with semicircular projections upon its upper edge. Upon the front projection is formed a scale. The rod of a pendulum passes up through the slot, and has a knife-edge crosshead attached to its upper end. A pointer is pivoted to the pendulum and receives a pin, which serves as a fulcrum. The pin is bent at right angles, and is passed through a hole in another pin, which may be turned with a screw driver to adjust the pin first mentioned, which is secured adjustably in the hole by a set screw. The upper end of the pointer passes up to the scale, so as to indicate the angle of inclination of the object to which the instrument may be applied.

Improved Garden Rake.

Frederick B. Hedge, Greenport, N. Y.—This invention consists of a garden rake having a series of concave teeth or tines with sharpened ends at one side, and concave and larger teeth at the other side, for being used, as required, for breaking the earth or for drawing furrows.

Improved Motor for Light Machinery.

David Baldwin, Midland Park, N. Y.—This machine is a stool or seat, on which the operator sits and gives a rack the reciprocating motion instead of using his feet, the reciprocating motion being converted to a rotary motion. The motor is adapted to sewing machines and similar light mechanism.

Improved Street Sprinkler.

William Westerfield, New York city.—In the main tank is a valve tank, to contain the valves, and to which the sprinkling tubes are connected, the said tank being connected to the principal tank by a pipe. This valve tank will have a portion of the cover contrived to be readily removed to afford access to the valves, for adjusting them and for other purposes.

Improved Clothes Line.

Thomas S. Cary, Brooklyn, N. Y.—This invention consists in having a double pulley block attached at a window sill; and opposite it, near the other end of the same window sill, is a single pulley block set on a building opposite, through which the traveler rope runs. Thus, when fully extended, there will be two clothes lines full instead of one, as heretofore, thus saving time, labor, and space, both in extending the line and also in taking in the clothes.

Improved Feed Water Heater.

Horatio N. Waters, West Meriden, Conn.—The corrugated pipe through which passes the exhaust steam is attached to the head of the heater, and thus suspended within it; and a branch pipe extends therefrom, down through the bottom of the heater, to carry off the water of condensation. Said branch pipe is fitted in a stuffing box so as to have free vertical movement corresponding to the vertical expansion and contraction of the corrugated steam pipe under the variations of temperature. By this construction and arrangement of parts, the leakage incidental to the ordinary feed water heaters is effectually avoided, since the joints or other parts of the heater are subjected to no strain in consequence of variation in the degree of temperature.

Improved Sawing Machine.

John Gehr, Clear Spring, Md.—The invention consists in the main shaft of a sawing machine provided with ratchets, pawls, bars, and yokes, whereby light work may be done rapidly, and heavy work slowly, by hand, while horse or other power may readily be applied when desired.

Improved Car Coupling.

William Green, Hyde, England.—The invention consists in employing as a car coupler a pivoted hook closed by a rear spring and opened by a lever, thus entirely avoiding the use of pins that are so often lost or stolen, and dispensing with all complication of parts that render it liable to frequently get out of order.

Improved Bee Hive.

Julius S. Coe, Mont Clair, N. J.—This invention consists of a bee house and bee hives combined, and is so constructed and arranged that the room containing the hives is protected on all sides by a series of dead air spaces, and provided with thorough ventilation. The air inside may thus be kept at any desired temperature, quite independent of the exterior atmosphere. It is claimed that this device insures a certain crop of honey, fully protects and preserves the bees in winter, prevents the operator's being stung, and that, when thus constructed, a house and fifty hives will cost a third less than the same number of good outdoor hives, and yield a much larger and more certain profit.

Improved Hydraulic Packing.

John F. Taylor, Charleston, S. C.—This invention relates to an improved hydraulic packing, and it consists in a ring of rubber or other elastic material contained within a cup ring of leather, and attached to the same at one side and free at the other, and the whole disposed within a groove in the cylinder. The water enters the loose side of the cup ring and presses it tightly against the ram, the rubber serving to accommodate the unequal thickness of the leather, and keep the latter always in proper place.

Improved Wooden Barrel.

H. W. Fitzhugh, Bay City, Mich.—The invention consists in using straight staves having parallel edges, with constricted bands whose overlapping ends are fastened by a screw extending into the wood. This enables the barrel to be made entirely by machinery, and renders coopering unnecessary.

Improved Shirt Bosom Supporter.

James S. Edmunds, Princeton, Ky.—The object of this invention is to cause the shirt bosom to stand out prominently and evenly from the breast of the wearer. The device consists of elastic longitudinal metallic strips connected by ribs and plates.

Improved Fish Plate and Rail Fastening.

Joseph M. Kenny, Blairsville, Pa.—This invention relates to certain improvements designed to give greater security to fish plates and fastenings for railroad rails; and it consists in a bolt having a locking bit which, when turned, occupies the position transverse to the slot in the rail and plate. The rail is slotted to allow for expansion and contraction, and the bit rests in a space between the rail and the fish plate which receives the nut. The said plate is indented upon its exterior surface with depressions which prevent the nut from turning, and the bolts are provided with diamond-shaped heads, by means of which the position of the locking bit upon the inside may be determined.

Improved Lamp Extinguisher.

Professor Wm. H. Zimmerman, Chestertown, Md.—The object of this invention is to provide a means for extinguishing lamps, in which the danger resulting from blowing down the chimney is avoided, and the habitually foul snuffing devices dispersed with. It consists in a hollow rubber ball, or other compressible air chamber, combined with the burner of the lamp by means of a flexible tube, so as to direct a blast of air upon the wick by squeezing the ball. The vents or quenching tubes are of a construction adapted to any kind of lamp burner; and the blast directed by them upon the wick being horizontal, or inclined upwardly if desired, the danger resulting from the old way of blowing down the chimney is avoided.

Improved Corn Planter.

Silvanus P. Evans, Ash Ridge, Ohio.—The invention relates to improvements in walking planters. The machine includes means for adjustment of the shafts and longitudinal beams, also a conical-shaped seed-spreading or distributing device which is pivoted within the seed spouts, so that it may swing and adjust itself to the vertical inclination of the seed spouts, and also to devices forming an adjustable connection between the seed spouts and bars or devices for covering the seed in the furrow.

Improved Gate Latch.

Robert C. Bernard, Rocky Mount, Va.—This invention relates to certain improvements in gate latches. It consists in the combination with a double catch attached to the gate post, of a lever pivoted to the gate at one end and weighted at the catch, and a second lever pivoted in the middle and weighted at the end farthest from the catch, so that gravity causes both levers to latch the gate, one above the catch and the other below the same. These two levers are connected by a vertical bar, by means of which both levers are operated at once to open the gate, for the convenience of persons on horse back, in connection with which said bar and levers a knob is used for pedestrians.

Improved Hydro-Electric Lamp.

Professor Wm. H. Zimmerman, Chestertown, Md.—The object of this invention is to provide a safe and practical self-lighting lamp, and it consists in a hollow lamp pedestal filled with sulphuric acid and water, or some other suitable exciting fluid, and containing an inverted bell jar with suspended bits of zinc in the same to form a Döbereiner apparatus. To said pedestal are attached two brackets, in one of which is supported a small galvanic battery, and in the other an ordinary coal oil lamp having in its burner a tube connecting with the hydrogen generator, which directs a jet of hydrogen upon the wick of the lamp. Said jet passes over a piece of platinum wire conducting the two electrodes of the battery, which, when the elements of the battery are brought into operation, ignites the jet, the battery and the hydrogen generator being so connected that the depression of a single lever synchronously turns on the hydrogen, and brings the elements of the battery into contact.

Improved Lemon Press.

Henry Newberger, Fort Wayne, Ind.—The object of this invention is to press lemons so that the juice will be more thoroughly squeezed out and made to flow into the glass or receptacle without any admixture of dust or specks from the air. The device consists of a convex plunger which fits into a correspondingly concaved basin that receives the lemon or section of lemon, and has a medium aperture through which the juice is expressed.

Improved Horse Hay Rake.

Benjamin Mellinger, Mt. Pleasant, Pa.—This invention relates to certain improvements in horse rakes, and it consists in a frame having a bent lever pivoted thereto, and provided with a stop hook, a traction rod with bifurcated ends and adjusting holes, and a cleaner attached to branched rods, all combined and arranged for the purpose of affording an improved means for lifting and manipulating the rake.

Improved Cartridge Belt.

David Taylor, U. S. A., Leavenworth, Kan.—The invention consists in a cross slotted belt provided with an interlacing strap, and a clamp having lower extensions bent backwards, and wings forwardly bent toward each other until the opposite edges nearly or quite meet.

Improved Motor.

John M. Cayce, Franklin, Tenn.—The object of this invention is to enhance the practical value of a gravity motor, by securing the best effects of the force of gravity, with a comparatively small expenditure of power for restoring the actuating weight to its original position for a continuance of the motion. It consists in the combination with a pivoted support bearing a weight, of a spring and rock seat, the latter rigidly attached to each other, and so combined with the support as to transmit the full power of the weight through the rock seat to the running gear, and yet to admit, through the auxiliary agency of the springs, of the shifting of the weight to the opposite side of its fulcrum by a smaller application of power than its own gravity. It also consists in the devices for shifting the said weight, and in means for adapting the principle of the motor to industrial purposes.

Improved Invalid Bedstead.

James Goodwin, Lennoxville, P. Q., Can.—This invention relates to certain improvements in invalid bedsteads, and it consists in an adjustable stretcher frame arranged above the bed and provided with hinges at the four corner posts, by means of which the whole stretcher may be adjusted inclinedly at one time, for adapting it to be used as a fracture bed. The stretcher is also provided with hinged head and foot frame operated by cords and pulleys for placing the patient in sitting posture. It also consists in a shaft under the bed provided with radial arms which are united at their extremities by a connecting rod passing through the hem of the sheet, by means of which the patient may be turned from one side to the other, the said device being operated by a windlass with a cord and pulleys.

Improved Blacking Brush.

Andrew McElrath, New York city.—The invention relates to a blacking brush constructed with a hollow back, which is adapted to receive the implements commonly required in the operation of polishing boots or shoes, such as a cleaning tool and brush, a brush for applying the blacking, a box of blacking, etc.

Improved Tea and Coffee Pot.

Louis Evans, Pittsburgh, Pa.—The invention consists in a coffee pot having a cone-shaped bottom, a perforated false bottom, and a cup, so arranged that, as the water percolates through the coffee and false bottom, all the essence thereof is carried into a separate chamber, all the internal parts being so connected that they can be lifted out together by a central handle.

Chief Engineer's Office, U. S. Navy Yard,
WASHINGTON, November 18, 1874.

Commodore Thos. H. Patterson, U.S N., Commandant:

SIR:—In obedience to your order of October 5th, 1874, to carefully test the EMPIRE PORTABLE FORGE, manufactured at Troy, N. Y., I have the honor to submit the following report:

* * * * * * This is a very excellent and convenient forge. It works easy and with but little noise, and the power being applied with a lever, it can be worked without interfering with the manipulation of the fire.

I can recommend it as a very useful tool for work on ship board or shop use.

Very respectfully, your obedient servant,
[Signed] EDWIN FITHIAN,
Chief Engineer, U.S.N.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Agricultural Implements, Farm Machinery, Seeds, Fertilizers. R. H. Allen & Co., 189 & 191 Water St., N.Y.

Magic Lanterns, Stereopticons of all sizes and prices, for Parlor Entertainment and Public Exhibitions. Pays well on small investment. Catalogues free. McAllister, Man'f'g. Optician, 49 Nassau St., N. Y.

We will sell the right of a few States for Cole's Automatic Boiler Feed Regulator cheap, if applied for soon. Has been in use over a year, and is a decided success. H. S. Cole & Co., Milwaukee, Wis.

Thomas's Fluid Tannate of Soda never fails to remove Scale from any Steam boiler; it removes the scale-producing material from all kinds of water; cannot injure Boiler, as it has no effect on iron; saves 20 times its cost both in Fuel and repairs of Boiler; increases steaming capacity of Boiler; has been tested in hundreds of Boilers; has removed Bushels of Scales in single cases. It is in Barrels 500 lb., ½ Bbls. 250 lb., ¼ Bbls. 125 lb.. Price 10 cents per lb., less than ½ price of other preparations, and superior to all others. Address orders to N. Spencer Thomas, Elmira, N. Y.

Partner Wanted—$6,000 to $20,000—in a Wilmington Coal Mine, 57 miles South of Chicago. Open, with good Established Trade. Address J.Q.A.King, Joliet, Ill.

Trojan Brick Machine—with Trucks and full set Moulds—been used part of a season—in perfect order—works well—made by Ferguson and Ralston, Troy. N. Y. For sale cheap, by Gridley & Reed, Waterloo, N. Y.

For Tri-nitroglycerin, Mica Blasting Powder, Electric Batteries, Electric Fuses, Exploders, Gutta Percha Insulated Leading Wires, etc., etc., etc., result of seven years' experience at Hoosac Tunnel, address Geo. M. Mowbray, North Adams, Mass.

Wanted—Estimates on finest wood engravings—4x5 inches—Landscapes. Send specimens. H. L. A. Culmer, Salt Lake City, Utah.

For Sale—A Valuable Patent, for what one State right can be shown to be worth. Address W. M. Coombs, Titusville, Pa.

Wanted—Second Hand Fire Brick Block Presses. S. B. Miller, 309 South 5th St., Philadelphia, Pa.

Miller's Brick Presses for fire and red brick. Factory. 309 South 5th St., Philadelphia, Pa.

A mechanical draughtsman, of 12 years thorough experience in different branches, is open to an engagement. Best of references given. Address A. B., care of Markt & Co., 143 Centre St., New York.

For Sale—Valuable Manufacturing Property; commodious buildings; driving-power, shafting, belting, etc; good order. Great sacrifice. For description, address "The Cosmos," St. Charles, Mo.

Carpenters Wanted—As Agents for "Patent Tool." Address Nicol Beach & Co., Rockford, Ill.

Speed Indicator—Every mechanic needs one; can carry in vest pocket. Satisfaction guaranteed. By mail, $2. Sam'l Harris & Co., 45 Desplaines St., Chicago.

Wanted—Parties to manufacture a first class Sectional Safety Boiler. Terms liberal. Profits large Address S. T. Russell, Springfield, Ohio.

The Whitmore Engine, 4, 5 and 10 H.P.—Cheapest, best, and safest. Vertical Tubular Boilers, all sizes, at reduced prices. Lovegrove & Co., Philadelphia, Pa.

For the cheapest and best Small Portable Engine manufactured, address Peter Walrath, Chittenango, N.Y.

See N. F. Burnham's Turbine Water Wheel advertisement, next week, on page 237.

Diamond Carbon, of all sizes and shapes, for drilling rock, sawing stone, and turning emery wheels, also Glaziers' Diamonds. J. Dickinson, 64 Nassau St., N.Y.

The Varnishes and Japans of the London M'f'g Co. compare favorably in price with, and are unexcelled in purity, durability, and color by, any first class houses in Europe or America. Hyatt & Co., office 246 Grand St., New York; Factory, Newark, N. J.

Steam and Water Gauge and Gauge Cocks Combined, requiring only two holes in the Boiler, used by all boiler makers who have seen it, $15. T. Holland, 57 Gold St., New York.

Price only $3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 263 Broadway, New York.

Tin Manufacturers, who have waste strips, pieces, or round blanks to sell, address—giving sizes—Norton Bros., 44 & 46 River St., Chicago, Ill.

Zero-Refrigerator with Water Cooler. Best in the World. Send for Catalogue. A. M. Lesley, 224 W. 23d street, New York.

The Lester Oil Co., 183 Water St., N.Y., Exclusive Manufacturers of the renowned Synovial Lubricating Oil. The most perfect and economical lubricant in existence. Send for Circular.

For small size Screw Cutting Engine Lathes and Drill Lathes, address Star Tool Co., Providence, R. I.

Wash Stands, New Styles, Marble Tops, can be used in any situation. Prices very low. Send for a catalogue. Bailey, Farrell & Co., Pittsburgh, Pa.

Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

Genuine Concord Axles—Brown, Fisherville, N.H.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass. Send for sample and price list.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon. 470 Grand Street New York.

Send for Circular of a very Superior Boiler Feed Pump. D. Frisbie & Co., New Haven, Conn.

W. Campbell's Self-Acting Shade Rollers. The Trade supplied, 87 Center Street, New York.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $6, with good Battery. F. C. Beach & Co., 263 Broadway, New York, Makers. Send for free illustrated Catalogue.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

Buy Boult's Paneling, Moulding, and Dove-tailing Machine. Send for circular and sample of work. B. C. Mach'y Co., Battle Creek, Mich., Box 227.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

Temples and Oilcans. Draper, Hopedale, Mass.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York.

All Fruit-can Tools, Ferracute, Bridgeton, N. J.

Grindstones—4,000 tuns. Berea Stone Co., Berea, O.

Notes & Queries

W. H. A. will find directions for bleaching beeswax on p. 299, vol. 31.—W. M. will find a recipe for silver-plating solution on p. 299, vol. 31.—W. H. M. will find directions for coloring putty on p. 107, vol. 31.—R. C. J. can plate iron with silver by the process given on p. 314, vol. 24.—W. H. W. will find an explanation of sailing faster than the wind on p. 176, vol. 28.—R. H. H. will find directions for bronzing on iron on p. 283, vol. 31.—H. E. will find directions for case-hardening iron on p. 69, vol. 31.—F. E. H. will find a recipe for marine glue on p. 43, vol. 32.—E. E. W. will find the recipe for furniture polish and also for finish for black walnut on p. 315, vol. 30.—J. K. S. and J. S. S. should each consult a physician.—C. G. M. will find a description of the wonder camera on p. 26, vol. 31.—C. C. S. will find directions for preparing muriate of ammonia for inhalation on p. 315, vol. 31.—W. H. and many others are assured that there is not and cannot be an instrument for indicating hidden treasure.—J. D. will find directions for softening and toughening wood on p. 319, vol. 31.

(1) W. J. A. asks: Will nitro-glycerin explode through a capillary tube? A. If we understand your question, yes.

(2) C. D. B. asks: What kind of oil is the best to preserve shoe leather, and to keep it soft? A. You will find neatsfoot oil the best.

Will a compound of cologne, hartshorn, tincture of cantharides, oil of lavender, oil of rosemary, and oil of nutmeg injure the skin? A. Probably not if used only a few times, and not in excessive quantity. Cologne is mostly all alcohol, which has a very injurious effect upon the skin, if used frequently, by dissolving out the natural oils, leaving the skin harsh and dry. If in the formula you present the oils are in excess of the alcohol or cologne, then the cologne is of no use on the skin and can be dispensed with; if, on the other hand, the cologne is in excess, the oils are of no use, as the uncombined alcohol is free to unite with the oils and fats of the skin. Unless the skin is diseased, the best lotion is cold water.

(3) F. S. asks: How can I use india rubber in either turpentine or naphtha without impairing its elasticity? A. Caoutchouc dissolves in bisulphide of carbon, coal naphtha, and rectified oil of turpentine. In these liquids it first swells up very considerably, and eventually forms a ropy liquid, which, on evaporation, leaves the caoutchouc with its original elasticity.

(4) F. W. asks: How is nitro-glycerin made, and how is it exploded? A. See p. 91, vol. 32.

Is there such an invention as the screw of Archimedes for elevating water? A. The screw of Archimedes, called after the philosopher that invented it, is one of the simplest machines for raising water, and operates at only short distances. It consists of a tube wound spirally round a solid cylinder, the lower end of which dips beneath the water at an angle of about 35°, the upper end being supported by a suitable arrangement, and fastened on a crank, which serves to rotate it.

(5) R. S. G. asks: What are the ingredients of Seidlitz powders? A. Rochelle salts 1 drachm, carbonate of soda 25 grains, tartaric acid 20 grains. Dissolve the two first in a tumbler of water, then add the latter, and drink immediately.

(6) N. P. K. asks: 1. How can I prepare hard enamel? A. Mix 100 parts of pure lead with 20 to 25 of the best tin, and bring them to a low red heat in an open vessel. The mixture then burns nearly as rapidly as charcoal, and oxidizes very fast; skim off the crusts of oxide successively formed, till the whole is thoroughly calcined. Then mix all the skimmings and again heat as before, till no flame arises from them, and the whole is of a uniform gray color. Take 100 parts of this oxide, 100 parts of white sand, and 25 or 30 of common salt, and melt the whole by a moderate heat. This gives a grayish mass, often porous and apparently imperfect, but which runs to a good enamel when afterwards heated. 2. How can I bring a low quality of gold to the color of 18 carat gold? A. Alloy it with the proper proportion of silver and copper. 3. I have a quantity of silver melted with lead; it is so brittle that I cannot roll it. How can I get it in condition to work? A. The desired object may be attained by melting the alloy in a cupel formed of bone ashes. The lead is gradually oxidized, melted, and absorbed by the porous material composing the cupel.

(7) H. P. A. says: I am now using the sap part of the white wood tree, cut to the thickness of 36 to the inch. In order to cleanse it of the sap and woody taste, I boil and frequently change the water, yet do not get it tasteless. How can I cleanse it of the taste without injuring the strength of the wood? A. Try weak lye, and water afterwards.

(8) T. B. C. asks: Is there any way of restoring marble that has been spotted with lemon juice? A. Marble being a carbonate of lime, the action of such an acid upon it would be to enter into combination with the lime, expelling the carbonic acid, forming a different body from the original marble; and from the fact of its being a mealy powder, it was easily wiped away without notice, leaving behind it the blur or depression in the surface of the polished plate you speak of. We do not think it can be remedied.

(9) H. S. says: What is the simplest way to make an apparatus for blowing glass, such as is used by men that travel the conntry? A. What you require is a current of air forced upon a flame produced from a wide illuminating surface, as a large wick, or, better, a gas flame widened and then subjected to the current of air.

(10) A. C. B. asks: 1. Is there any way to harden coin silver? A. We do not know of any. 2. Is there any hard metal or alloy that can be used for fine work, and will not scale when heated? A. Try the alloy known as packfong, or German silver, a compound of nickel, zinc, and copper, in which the proportions vary considerably. A good alloy consists of 5 equivalents of copper, 3 of zinc, and 2 of nickel. Packfong is of a yellowish white color, and, when newly polished, closely resembles silver in appearance.

(11) F. C. asks: Will anything dissolve lithia carbonate except carbonic acid water? A. Yes, ammoniacal salt.

(12) H. H. asks: How can I make bisulphate of tin? A. You probably mean bisulphide of tin ($Sn\,S_2$), known also as mosaic gold; it forms a beautiful yellow flaky compound, which is obtained by preparing an amalgam of 12 parts of tin and 6 of mercury; this is reduced to powder and mixed with 7 parts of sublimed sulphur and 6 of sal ammoniac. This mixture is introduced into a flask with a long neck, and is heated gently so long as any smell of sulphuretted hydrogen is perceptible; the temperature is then raised to low redness calomel and cinnabar are sublimed, and a scaly mass of $Sn\,S_2$ remains. If the heat be pushed too far, part of the sulphur is expelled and the operation fails; the sal ammoniac appears by its volatilization to moderate the heat produced during the sulphuration of the tin, which would otherwise rise so high as to decompose the bisulphide.

(13) F. C. and others.—Most medical authorities agree that the right side is the better to sleep upon; but this is not always the case, the number of persons who sleep upon the left being as many as those who use the right side. It is simply a matter of convenience and ease, it being folly to insist upon a person to use one side when it is a discomfort.

(14) J. W. asks: 1. What is the tenacity of gold? A. It will take 24·20 lbs. weight to break a gold wire having a sectional area of a square millimeter, if the gold be annealed. If the gold be drawn, it will require 61·60 lbs. to break it. 2. When gold is consumed by fire, what is the color of the flame? A. Molten gold exhibits a sea green color. 3. What is the color of light transmitted through a pellicle of silver? A. Bluish. 4. When silver is consumed by fire, of what color is the flame? A. The spectrum of silver is green. 5. How can cinnabar be converted into a yellow pigment? A. Continued pulverization will change the brick red color of cinnabar to an orange yellow.

(15) F. W. B. says: I have some white silk which has become yellow by washing. How can I restore it to its original color, without injuring the silk? A. Try steeping it for a short time in vinegar or lemon juice, after having perfectly cleaned it. Rinse in cold water.

(16) J. H. L. asks: How can I illuminate tableaux with a strong light, and have changes of color without resorting to the use of disagreeable compounds? How can I prepare and use the calcium light for the above purpose? A. The magnesium light is sometimes used for this purpose. The method of obtaining it consists in burning magnesium ribbons which may be obtained from any chemist or dealer in theatrical goods. In the calcium or lime light, an ignited jet of the compound gas (oxygen and hydrogen) is caused to impinge against a small cylinder of caustic lime. In the apparatus used for this purpose, the gases are conducted by separate tubes to the burner, which they enter at opposite sides, a few inches from the tip of the burner. The burner or jet should be bent towards the vertical surface of the lime at an angle of about 45°. The lime should approach the tip of the jet within $\frac{1}{16}$ of an inch. The gases are kept in separate bags of india rubber. The oxygen gas is obtained by heating together, in an iron or copper bottle, chlorate of potash with one quarter its weight of peroxide of manganese. Hydrogen gas may be obtained by acting upon scraps of zinc in a large bottle with dilute sulphuric acid. The first portions of the gas, if obtained in this manner, should be allowed to escape, otherwise its mixture with the air in the apparatus forms a very explosive mixture. Ordinary illuminating or coal gas, if obtainable, will answer the purpose as well as pure hydrogen. Both the above gases are washed before being allowed to enter the bags. This is arranged as follows: A small bottle is obtained, which is partially filled with water; through a tightly fitting cork in the mouth of the bottle pass two glass tubes, one of which passes down and dips beneath the surface of the water, the other barely passes through the cork. In order to use this washer, the tube which dips under the water is attached by rubber tubing to the generating flask, and the end of the other tube, which just passes through the cork, is attached to the receiving bag. Thus arranged, the gas as generated is required to pass through the water. Care should be taken (in the generation of the oxygen) at the end of the operation that the water in the bottle does not run back into the generating flask, otherwise an uncontrollable quantity of steam will be generated from contact of the moisture with the hot metal.

(17) F. N. J. and others.—The statements made as to the preparation of musk are on the authority of a work recently published on perfumery, and presumably reliable.

(18) D. S. M. asks: 1. What effect will alum water have on flour when used for dampening wheat before grinding it? A. Probably the same as when applied after the wheat is ground, as is often done by bakers. 2. Will it toughen the wheat so as to give a better yield? A. We think not. 3. Is it injurious to health? A. Yes. This method of whitening the bread is prevented by heavy fines and penalties in England.

(19) S. C. B. asks: Does soap boilers' refuse contain anything unfavorable to its use for agricultural purposes? A. Not that we know of.

(20) W. O. P. says: We frequently find melted lead flowing from stove and grate in which we are burning coal. A boy once showed me a piece of what I presume was lead ore; I could cut it with ease with my pocket knife. A few days ago we heard a snapping report in the stove, and melted lead splashed out on the floor and burnt my brother's hand. Are not these facts indications of lead in quantity somewhere in the district? A. Yes. 2. If so, would it be found above or below the coal vein? A. It might be found below as well as above. 3. If there be lead, how could the vein be most easily found? A. By carefully examining the exposures of the rocks for the vein, and by surface indications of minerals containing lead.

(21) K. B. F. asks: Is carbolic acid a poison taken internally or applied outwardly? A. It is a poison in both cases. It acts similarly to creosote.

(22) S. T. asks: How are paper magnetic fish made, so that when they are put in the palm of the hand they will draw up and turn over as if alive? A. They are made of thin gelatin, called gelatin paper. Collodion films may also be used for the same purpose.

Will tobacco smoke have any effect upon soft rubber tubing? Will vinegar corrode it? A. Neither will have any permanent effect.

(23) J. S. & Co. ask: What is a good solution for tempering steel for drilling rock? A. Be careful not to overheat it in hardening and forging, and quench in salt water, drawing to a brown color.

(24) J. P. S. says: I recently came across a strange stone; it weighs 2 or 3 tuns, and is formed of small stones about the size of a hen's egg. It seems to have been ground off on the outside, for it is perfectly smooth. It lies half a mile from a small stream, and on a hill fully 100 feet above the stream. What is it? A. Such rocks are called conglomerates, and are quite common in some parts of New England and elsewhere.

(25) O. A. Jr. asks: How can I drill hard cast iron, without annealing it? A. Harden the drill to a straw color, and run it slowly.

Should an icehouse be set on or above the ground? A. See p. 251, vol. 31.

(26) W. W. B. says: An apparatus for gold and silver plating is constructed as follows: Bath: 4 ozs. cyanide of potassium and 4 ozs. carburet of ammonia, dissolved in 1 gallon rain water. Then add 12 grains gold (or silver), apply battery, and add blue vitriol until a blue color is obtained. Battery: Put nitric acid in the porous cup, and diluted sulphuric acid in the outer. Suspend a carbon plate in the porous, and zinc in the outer, with small copper wires. I use the gold solution hot. I am very careful to clean thoroughly the articles plated, but the work will not last six months. Can you inform me of a process by which I can do plating that will last one, two, or three years? A. To make a silver solution, dissolve the silver in four parts of nitric acid and one of water; the diluted acid is heated in a vessel and the silver added by degrees. After the metal is dissolved, put it in a large vessel and dilute with water. Then add a solution of cyanide of potassium so long as a white precipitate is formed. When the precipitate of cyanide of silver has settled, the clear solution is carefully decanted, and the vessel filled with water, which is again decanted as soon as the precipitate has settled. Repeat this three or four times, and then add a solution of cyanide of potassium until the precipitate is all dissolved. The solution is then ready for use, after filtering. Dilute the cyanide of potassium so that the plating solution shall contain one ounce of silver to a gallon. A preparation of solution of gold is prepared by dissolving gold in three parts muriatic acid and one of nitric acid, which forms the chloride of gold. This is digested with calcined magnesia, and the gold is precipitated as an oxide. The oxide is boiled in strong nitric acid, which dissolves any magnesia in union with it. The oxide, being well washed, is dissolved in cyanide of potassium, which gives cyanide of gold and potassium. A Smee or Daniell battery is better than a carbon battery for silver and gold plating.

(27) B. D. T. asks: How are plow castings chilled? A. Cast them in an iron mold, and let them cool in the mold.

(28) L. G. asks: 1. What kind of grease is best to use in the oil cups of engine cylinders? A. Tallow. 2. Which oil is best to use on engine slides? A. Lard oil.

(29) Y. P. says: I have made a nickel solution of 1 lb. sulphate of nickel, and 4 ozs. sal ammoniac or chloride of ammonia to a gallon of sul-

phate of nickel. I used fluid ammonia to make it neutral. I use a 3 cell Smee battery. The work comes out black. Can you give me a remedy? A. Dissolve the nickel in nitric acid and then add carbonate of potash to precipitate the metal. Wash this well and dissolve it in cyanide of potassium. Use a plate of nickel for a positive electrode. Dissolve your platinum wire in a mixture of nitric and muriatic acids. Wash your silver plate in nitric acid and brush it until a frosted appearance is obtained. Then wash it in water thoroughly, and place it in a vessel containing dilute sulphuric acid and a little nitro-muriate of platinum. Place in the vessel a porous tube containing a few drops of dilute sulphuric acid. Put in the tube a piece of zinc and connect the zinc with the silver plate. In a few seconds the platinum will be deposited upon the silver as a black powder, and the platinized silver is ready for use.

(30) H. M. D. asks: What is the best method of truing up an ordinary carpenter's grindstone? A. Use a ¾ bar of iron, or a gas pipe, for a turning tool, below the center of the stone.

(31) A. J. G. says: I have a tin roof laid on matched boards, which is 20x34 feet. It is nearly airtight, without any windows. In cold weather, a very heavy coat of hoar frost collects inside; and when it thaws, the moisture drops down to the plastering and is spoiling all of the ceilings in the upper stories. Can I prevent the hoar frost collecting by putting a ventilator in the center of the roof? If so, what construction is best? A. The appearance of water in such quantities under your roof would seem to indicate a concealed leak in the tin; but if the frost shows itself in every part, and there is evidence that it arises from the condensation of water from the atmosphere, it is, to say the least, rather unusual, and the remedy should be sought in an increased ventilation. Your best plan to effect this will be to provide openings under the eaves of the house, and on two opposite sides thereof, so that the air may pass through the roof space: these may be placed close under the roof cornice, so that they may be protected from the entrance of rain, etc.

(32) W. M. L. asks: What kind of treadle should I put on a foot lathe to use either end of the lathe? A. Make your treadle as long as your lathe bed.

(33) F. E. W. says: In your answer to W. E. W. you say that musk is prepared from a root. In Griffith's "Universal Formulary" may be found the following: "Musk is a peculiar concrete substance obtained from the *moschus moschiferus*, a small animal of the deer kind, inhabiting the mountainous regions of Central Asia. The musk is secreted in the male, in an oval sac, situated near the generative organs. It is found in commerce in these sacs; it is concreted or granular, of a brownish color, soft and greasy to the touch, of a powerful, penetrating odor, and of a bitter, unpleasant, and somewhat acrid taste. From its high price, it is very liable to adulteration. It is antispasmodic and stimulant, and has been much used in spasmodic diseases of all kinds, as well as a stimulant in low states of the system. The dose from five to ten grains."

(34) W. M. N. asks: How can we temper steel springs made from the ends of Bessemer rails? A. Try a very low red heat, and quench right out in water.

(35) S. C. C. D. says: 1. F. wants an internal gear made with pinion turning on same center, both to revolve in definite proportions (say two or three to one). I contend that there must be an intermediate to transmit the motion. Am I right? A. Yes. 2. Please give the relative proportions. A. The proportions are the same as for outside gears.See p. 187, vol. 29.

(36) J. L. H. asks: 1. How can I temper cold chisels and punches? A. Heat to a red, and quench in water, drawing to a blue. 2. Can I make knives (for a shaping machine) out of vertical mill saws $\frac{1}{16}$ inch thick? A. They are excellent material for the purpose. 3. How can I anneal and temper them? A. Anneal in lime, and draw to a brown color.

(37) W. P. S. asks: Will a circular cutter on a lathe mandrel answer for beveling the edges of pasteboard for bookbinding? A. No. Such material should be cut with shears, to avoid a burr on the edge.

What kind of wood is best for cutting screws with a chaser or screw box? A. Boxwood.

(38) R. T. W. asks: What can I use in lard oil to prevent it from chilling or becoming thick? A. A good variety of kerosene oil would answer your purpose much better.

How can I procure the drawings, etc., of all machinery patented in the United States? A. Apply by letter at our office for copies of the patents. See our prospectus in this issue.

I have a mercurial thermometer which indicates −55° Fah. this winter. Can it be correct? I thought mercury congealed at −39°. A. Mercury freezes at 39·5° Fah. Lower temperatures are measured by thermometers in which the mercury is replaced by colored spirits of wine.

(39) H. L. C. asks: How much fuel is required to melt 1 tun of cast iron? A. Probably 2 or 2½ times the weight of the iron.

(40) N. D. S. says: I have a water tank made of two inch pine planks. It is round and hooped like a barrel, and is about 4 feet high and 4 feet in diameter. It is about 20 feet above the supply. I want to attach a supply pipe to the tank, put in a check valve with a safety valve on the top, and fill the tank with steam; and as it condenses, let it fill itself by the supply pipe. Will the tank stand the pressure? A. It will most likely be difficult to make your wooden tank steam-tight and keep it so. A better way to fill it by the direct action of steam is to provide a small cylinder below, supply the steam at the top of it, and have two pipes leading from the bottom, one down to supply the water to the cylinder, and the other up, through which to force the water to the tank. Provide proper valves to these pipes. Let the steam enter at the top and expel the air; condense the steam by a jet and the water will enter from the supply pipe and fill the cylinder; let the steam enter again on top of the water and it will force it down and out through the rising pipe to the tank; then condense the steam again, and the operation will be repeated. Now, if you make your valves work automatically, you have an automatic pump.

(41) N. C. H. asks: What will remove a coating of paint from windows? A. Try turpentine and linseed oil.

(42) W. B. W. asks: 1. Are the carbon points used for electric lights the same as used in Bunsen's batteries? A. Yes. 2. Would a double convex or a plano-convex lens increase the brilliancy of an electric light any more than a plain window glass with a strong reflector placed behind it? A. No.

(43) F. B. asks: What are the arrangements of the circuit in an induction coil, and what is the best material for the core? The coil is intended for a shocking machine. A. An induction coil consists of a primary and secondary coil wound into a bobbin, or each may be wound on a separate bobbin, and the one placed inside the other. The primary coil is made of wire $\frac{1}{12}$ of an inch in diameter and covered with cotton or wool; the secondary coil is made of silk-covered wire $\frac{1}{30}$ of an inch in diameter, and is ten or twenty times as long as the primary. The core consists of a bundle of iron wires. Attach a battery to the two ends of the primary coil, and when the circuit is closed or broken, a shock will be produced by taking hold of the two ends of the secondary coil.

(44) W. E. D. asks: 1. Which is the strongest magnet, one wound with fine or with coarse wire? A. For lifting weights, coarse wire; for working over long telegraph circuits, fine wire. 2. Does the size of the iron of which the poles are made make any particular difference as to the strength of the magnet? A. The iron should be about one third as thick as the coil. 3. I have made a magnet with spools 2½ inches long x1¾ inches diameter, outside measurement, and made the poles of ⅜ inch iron. I wound the spools with No. 26 insulated wire, putting 600 feet on both spools. The power is not as strong as I expected it would be. What is the cause? A. If you use more battery, your magnets will be stronger. 4. Will lightning strike insulated wire? A. Lightning will strike anything. 5. Supposing a line of galvanized wire is used outside, and is connected with insulated wire where it enters the house, would that be dangerous if I do not use lightning arresters? A. It would be dangerous to the instruments. You had better use the arresters.

(45) B. J. K. asks: 1. Is it true that, with Edison's automatic telegraph, 500 words can be transmitted per minute? A. Yes, on short lines, say 100 miles long or less. 2. Do you think it will ever be generally adopted and drive the sounder out of use? A. No. 3. Can you give me a description of it? A. It is substantially the same as Bain's telegraph. The additions are a new mechanical puncher and a method of neutralizing, to some degree, the static charge. 4. What books should a telegraph student read to obtain a perfect knowledge of telegraphy? A. Culley's, Sabine's, Pope's, Turnbull's, Shaffner's, Prescott's, Jenkin's, and Bakewell's in English. In German, Schellen's is the most complete work.

(46) A. F. O. says: I have heard just enough about the single fluid bichromate of potash battery to cause me to desire to know more about it. If it is, in point of simplicity and efficiency, what it seems to be, it is a most desirable addition to the laboratory. It uses but a single fluid, that can be kept in bottles for any length of time; the zincs and carbons cannot deteriorate when laid away, and must be ready for immersion at any time. No porous cells are needed. What are the chemical reactions, and in what manner does the exciting fluid deteriorate, how may it be renovated, and when must it be renewed? A. The single fluid bichromate of potash, or Grenet, battery is a very good form of an experimental battery where constancy of current is not required, as, for example, in the laboratory and mechanical workrooms. The cell is in the form of a bottle, and contains a mixture of 2 parts bichromate of potash, dissolved in 20 parts hot water and 1 part sulphuric acid. The top is provided with a brass frame, to which is fastened a wooden cover. To this cover are attached two carbon plates which permanently dip into the fluid; and between the carbon plates a zinc plate is suspended, which may be plunged into the fluid or withdrawn at pleasure. When the zinc is withdrawn, the action ceases. The battery gives a powerful current for a short time, but rapidly polarizes. The length of time during which the fluid will retain its power depends upon the use which is made of the battery. It is not suitable for continuous use; but in all cases where a powerful current is required for a brief period, it is a very desirable and economical apparatus.

(47) C. E. G. asks: Can I warm a three story wooden building, 80x45 feet, thoroughly by putting two hot air furnaces in the cellar? A. Your building is not so large but that it may be heated by two good sized ordinary hot air furnaces. Apply to the party from whom you intend to procure your furnaces before you build, so that the location and size of the flues (which should be large) may be properly determined.

(48) I. O. T. says: 1. I am making an induction coil; it is 7½ inches long, has a center bundle of soft iron wires of ⅝ inches diameter, and I propose to make it with a diameter of about 4 inches. The inducing coil consists of copper wire (100 feet to 1 lb.) and there is about 40 yards of it. On this is now coiled 700 feet of wire (14,000 feet to 1 lb.) and I get quite a strong shock. How much more of a smaller size (18,000 feet to 1 lb.) ought I to coil on this to get a spark of at least ¼ inch long? A. You would require to add a condenser to accomplish this. 2. My battery is of the Callaud gravity kind, made in quart glass jars. How many of these will equal one of the Daniell kind? A. One. The electromotive forces of the Callaud and Daniell battery are similar. 3. In these batteries, what would be the effect of leaving the wire from the copper plate on the bottom of the jar uncovered? A. It would be eaten off. 4. If the strength of the induced current depends upon the intensity of the inducing current, why not pass the current into a small induction coil and then use the induced current as an inducing one for a larger coil? A. It does not depend upon the intensity, but upon the quantity. 5. What is the black substance that falls from the zinc to the bottom of the jar? A. Copper, deposited in a metallic form. 6. Does it do any harm to let it collect? A. It ought to be removed occasionally. 7. The zinc is sheet zinc, amalgamated. Is this right? A. It ought not to be amalgamated. 8. What is the best form of battery that can be transported, and used while it is being transported, or while the liquids are agitated a little? A. Daniell's or Léclanché's. 9. What is the white salt-like substance that accumulates in the top of the jars? A. Sulphate of zinc, crystalized.

(49) C. M. B. asks: Should the follower pinch the rings of the piston, or should they be loose so as to be acted on by the springs? A. Let them be just movable by hand.

(50) C. F. B. says: 1. I made a battery of two cells, which fails to give a current. I filled the outer glass jar, 6 inches deep and 4 inches in diameter, two thirds full of a concentrated solution of sal ammoniac. In this I put an amalgamated zinc electrode (5 inches long by ¾ inch diameter. The carbons were packed tightly into the porous cups with a mixture of finely powdered black oxide of manganese and gas carbon, 3 parts of former to 1 of latter. Where is the mistake? A. You should use coarsely powdered manganese oxide. 2. In the battery made by C. and F. Fein, of Stuttgart, how are the platinum plates used to make the connection between the copper wires and the charcoal plates? A. They are clamped together. 3. How large are the plates? A. They vary according to the size of the jar. 4. How many Leclanché cells are required to ring an electric bell with 300 yards of ordinary telegraph wire, insulated? A. About 4.

(51) A. M. R. asks: How can I get intermittent rotary motion of a wheel, 12 inches in diameter, by cogs, an 8 inch wheel being on the driving shaft? A. Have cogs on the driving wheel that only act during a portion of the revolution.

Is there a dry color lighter than blue that will dissolve in water when cold? A. We think it quite likely. Apply to a manufacturing chemist.

(52) R. B. R. asks: How does the engine, illustrated as operating the water belt on p. 278 of *Science Record* for 1875, operate? A. A reciprocating engine will answer, as all that is necessary is to make the large wheel revolve at a high speed. In the engraving it appears to be a rotary engine.

(53) J. V. asks: Will ice form on the bottom of a river as well as on the surface, on either rocky or sandy bottom? A. No.

(54) E. B. T. asks: What is a good preparation with which to cover the deck of a boat? A. Good timber, well seasoned, is advisable. There are numerous patent processes for preserving timber by which it is said that green wood is rendered durable.

(55) X. asks: Why does the lead eccentric on any kind of a link motion engine wear away more quickly than the other? A. It ordinarily does more work than the other.

(56) H. P. asks: What sizes of cast iron and wrought iron screws are necessary for a cotton press, pressing 500 or 600 lbs. bales with one horse? A. Cast iron, 3 to 4 inches diameter; wrought, 2 to 3 inches. 2. Will an ordinary lifting pump raise water 32 or 33 feet? A. No. 3. What is the probable horse power of an engine, with a cylinder 6x12 inches stroke, pressure 50 lbs. at 100 revolutions per minute? A. From 10 to 12.

(57) F. H. H. asks: 1. Will any object sunk in very deep water remain suspended after reaching a certain depth? A. It is quite probable. 2. Is it true that divers have to hang weights upon themselves so as to keep at their work? A. It is frequently necessary, because the diving suit increases the displacement, and the water at the bottom is more dense than at the top.

(58) C. asks: Which part of a wheel revolving on the ground travels fastest going horizontally through the atmosphere? A. The top.

(59) L.E.D. asks 1. Does a native of a tropical climate suffer as much from cold in his own country as in a temperate one? A. A person accustomed to a tropical climate suffers more from cold. 2. Will he, going from a colder climate into a warmer one, suffer as much from cold as in the colder climate? A. He will suffer more by a certain fall of temperature in the warm climate than by the same decrease of temperature in the cold climate.

(60) W. L. says: I have a private telegraph line about one quarter of a mile long, and use a return wire instead of the ground. During a recent storm, a bracket came off one of the poles and for about one hundred feet the wires are wound one around the other. I supposed that the current from the batteries at either end would follow one wire to where they came together, and then return by the other wire to its original battery, and so make two local circuits, but no through current. But on opening my key, I found I could communicate with the office at the other end without any difficulty whatever, and we have been working with the line in that condition for a week with scarcely any inconvenience. It recently rained nearly all day, and for a short time I was unable to get a circuit; with that exception I have had no difficulty. I have come to the conclusion that the wires are very rusty and thus insulated. The wires swing enough to scrape all the rust off of each of them. Am I right in supposing that they are insulated by the rust? A. When two or more paths are open for the passage of an electric current, it will follow each in proportion to the facilities afforded. In the case in point a portion of the current returned *via* the cross, but enough got through to work the instrument. If the two wires had been a couple of hundred miles in length, very little of the current would have reached the distant end. If your two wires were laid on the ground without any insulation, they would work, because the current follows the wire in preference to the earth for so short a distance.

(61) I. M. W. asks: What is the difference between a galvanic and a faradic current, or between galvanization and faradization? A. The term galvanic is sometimes applied to currents produced directly from a battery, and faradic to those produced by induction. In other words, the former term is applied to primary and the latter to secondary currents. The distinction is rather fanciful, and not sanctioned by the best authors.

(62) T. B. S. asks: What is the rule for determining the electromotive force necessary to overcome a given resistance? A. The force required depends upon the power you wish to develope. The Atlantic cable can be operated with a battery consisting of a percussion cap, a bit of zinc wire, and a pinch of salt. This minute battery, which has an electromotive force of only half a volt, is sufficient to overcome the resistance of a wire extending across the ocean, and then to possess power enough to work Thomson's galvanometer. On the other hand, a small electric motor frequently only has 50 feet of coarse wire, and requires a battery of 50 volts to work it. The power or strength of current is ascertained by dividing the electromotive force by the resistance. Thus if E represents the electromotive force, R the resistance, and P the power of the current, then the following formula will always give it correctly: $P = \frac{E}{R}$.

(63) F. G. asks: What is the momentum of 1 lb. after 17 inches fall? What is its momentum after 198 inches fall? What is the formula used to solve such problems? A. Multiply the weight in lbs. by the time in seconds.

(64) J. L. B. says: 1. I am running an 8 horse power portable engine, and am troubled with foaming. What causes it, and how can I prevent it? A. It is probably caused by dirty water. Clean the boiler, and blow off frequently. It may be due to a defect in the boiler. 2. The barrel of my boiler is 30 inches in diameter, of ¼ inch iron, the firebox being a little thicker. According to Bourne's rule, I make the highest safe working pressure about 80 lbs. per square inch. Would it be unsafe to carry 100 lbs., which would be but little more than $\frac{1}{6}$ of the bursting pressure? A. We would not recommend it. 3. In a recent issue you recommend a good feed water heater and frequent blowing off to prevent scale. Do you mean to blow off a portion of the water from the bottom of the boiler? A. Yes. 4. Suppose two tight cylinders or barrels, each having a perpendicular pipe inserted, the pipes being of equal hight but of different diameters (½ inch and two inches respectively), and all these filled with water, would the pressure per square inch be the same in each barrel? A. At the same relative point in each, it would.

(65) W. H. G. asks: How is brass spun? A. The brass is secured to a pattern on a revolving mandrel, and a blunt tool is pressed against it. 2. Is there any work on the subject? A. We think not.

What is meant by mule spinning? A. The mule is a technical name of a machine for spinning cotton.

(66) W. H. C. says: 1. I supposed that water is only slightly condensed by the greatest pressure, but Steele's "School Philosophy" says the water at the bottom of the ocean is very much condensed by the great pressure. Is this correct? A. Water is compressed about 0·0000033 for each pressure of one atmosphere that is applied. 2. How much does this condensation amount to at the greatest depths? Is it true that, in the deepest parts of the ocean, heavy bodies, such as rocks or even iron and lead, do not sink to the bottom? Does the great pressure upon deeply submerged substances tend to increase their buoyancy independently of the condensation of the water? A. It is easy to see that, even with this slight compression, water may become much more dense at great depths. A submerged body is pressed downward by its own weight, and upward by the weight of an equal volume of water, so, of course, if the water is sufficiently compressed, any substance will float in it. 3. Do you think the freshly drowned human body, divested of clothing, will sink to the bottom of the deep sea? A. No.

(67) E. G. says: 1. I am making a sawing machine to run by foot power. What sized saw can I use? A. About 6 inches in diameter. 2. How many revolutions per minute should the saw run? A. About 400 or 500. 3. How many revolutions should a bit in a boring machine run per minute? A. About 400 or 500.

(68) T. B. K. says: Our steam tug ordinarily draws 9 feet of water, when loaded 10 feet. Her propeller is 7 feet 1 inch in diameter, with 4 blades; the greatest width of blades is 30 inches. It is placed as low down as admissible, so that its ordinary immersion is 2 feet below the surface of the water. It is driven by an upright 24 inch direct action cylinder, of 24 inches stroke. With 45 to 50 lbs. of steam she handles the wheel like a toy, and tows well. We are about to build a new hull, with same draft of water. We can carry 80 to 100 lbs

Can we not, with perfect propriety, carry a larger wheel? Our present shaft is 5½ inches. If we enlarge the wheel, will it be necessary to enlarge the shaft? A. We think that you can safely increase the diameter of wheel to 8 feet, and that a 5½ inch shaft will be large enough.

(69) L. H. R. asks: 1. I heard a gentleman from Utica say, the other morning, that his mercury thermometer stood at —41° Fah. Is it not to be doubted? A. The thermometer could not quite indicate correctly, as mercury freezes at —39·5° Fah. 2. Has alcohol ever been frozen? A. No.

(70) J. D. S. asks: Why would not the rotary blower, described in the SCIENTIFIC AMERICAN of January 23, 1875, make a good steam engine by admitting the steam at D and exhausting at E? A. It would probably not be economical.

How much will a cubic inch of nitro-glycerin expand on explosion? A. About 13,000 times.

(71) C. S. A. says: The amount of rain that has fallen in this country for the past ten years will average about 46 inches. If a vessel is set to catch rain water, and the water allowed to stand in the vessel as it falls during the year, what percentage of the water will be in the vessel at the end of the year, allowing the water to escape only by evaporation? A. It will vary in different localities, and must be determined by experiment.

What is meant by dry steam? A. It is steam that has no water mingled with it, and is commonly produced in a well designed boiler.

What is the average cost of building a railroad embankment, 6 feet high, with upper base of 10 feet and lower base of 28 feet, of earth dug along the sides of the embankment? A. Your question is too indefinite. You will find some valuable estimates for different cases in Trautwein's "Engineer's Pocket Book."

Are the engineers now at work on the tunnel from Jersey City to New York? A. No.

(72) S. T. says, in reply to L. H. H., who asked what to do with belts that have become glazed and hard: Run the belt very slowly, and sponge with warm water on both sides; then with a scraper take off the gum, and oil with neatsfoot oil. Attend to it once a month with the scraper and oil; the scraper should not be too sharp nor be straight on edge, but rounded a trifle. If your belt cannot be run slowly, take it off: but it is better to keep it on if possible.

(73) C. L. says, in reply to M. W. H., who asked if cherry tree gum is of any value for mucilage: Having made use of it for two years, I can answer, yes. It is darker, but I think fully as strong as gum arabic.

(74) H. A. H. says, in answer to several correspondents' inquiries regarding the power necessary to propel steam yachts, and the speed to be obtained by the use of a definite amount of power: Assuming that we wish to give the vessel a moderate speed, we calculate the resistance from the greatest immersed section:

$V=\sqrt{\frac{KLH}{A}}$, and $H=\frac{V^2A}{KL}$ where K=coefficient for speed and horse power, V=velocity in miles per hour, A=area greatest immersed section, H=horse power, L=length of boat on water line. In words, the speed in miles equals the square root of the length on water line multiplied by the horse power and by a coefficient, K, and divided by area of greatest immersed section in square feet. The second formula is: The horse power equals the square of the speed multiplied by the area of greatest immersed section in square feet, and divided by the length on water line multiplied by the coefficient. The coefficient mentioned above varies with the fineness of the lines, from 1·1 in very full lines to 1·9 in very fine lines. The above rules are found to agree very nearly with the performance of various steam yachts now constructed.

(75) H. M. W. says: It may perhaps interest F. C. G. and others to know of a method of taking off the tin from tinned plate without acid. I read a short account of it in the *Jahresbericht der Chemie*. It consists in boiling the scrap tin with soda lye in presence of litharge. This ought to pay, as there are plenty of objections to the use of acids, which unfit the iron for some uses.

(76) C. says, in answer to G. W. B., who inquires about removing clinkers from a stove: My experience is that if, when the stove is thoroughly hot, a few lumps of lime, or even oyster shells, are placed in the stove, as near the clinkers as possible, the latter will be softened or fluxed; and as the fire burns down, they may be scraped off with a poker or shovel.

(77) W. says, in reply to the question of A. B., asking the distance passed over by a fly on the rim of the driving wheel of a locomotive while the locomotive runs 50 miles, the driving wheel being 8 feet in diameter: The fly passes over a cycloid at each revolution of the wheel, and with such a wheel he will travel 32 feet at one revolution; and while the locomotive runs fifty miles, the fly will travel 63 miles, 3,494$\frac{4}{15}$ feet.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. F. W.—It is galena, a valuable lead ore.—A. B.—No. 1 is oxide of iron, with silex. No. 2 is copper pyrites, a valuable copper ore. No. 3 is black oxide of iron. Nos. 4 and 5 are talcose schist, not valuable. No. 6 is chlorite schist, not valuable. No. 7 is chlorite and micaceous schist. Nos. 8 and 10 are yellow oxide of iron in schist, not valuable. No. 9 is magnetite in steatite. No. 11 is red oxide of iron in schist. No. 12 is iron ore. No. 13 is copper pyrites, valuable. No. 14 is magnetic iron ore, good. No. 14 is mica schist, containing quartz, silex, and oxide of iron. No. 16 is mica schist. No. 17 is micaceous schist. Two other specimens are schist, somewhat stained with green carbonate of copper, not valuable.—J. M. H.—It is a carbonate of lime and magnesia, containing iron pyrites.—A. E.—No. 1 is clay, colored with hydrated oxide of iron. No. 2 is silicate of lime with augite. No. 3 is augite, a silicate of iron, manganese, lime, and magnesia. No. 4 is copper pyrites.—E. P. C.—It is bog iron ore, containing a large amount of insoluble silicious matter.—W. H. L.—It may be used as a polishing or cutting powder for metals and minerals.—G. S.—It is marcasite or white pyrites, and contains 47 per cent of iron and 53 of sulphur.—J. J. T.—It is composed of the same material as pure sand, which is used in glass making, etc., but it is too common to be of especial value. Finely crystallized pieces are prized as rock crystal. Some of the lower priced ornaments are sometimes cut from the last.—J. H. P.—The finer colored varieties of tourmalines are sometimes used as gems.—W. Y. T.—It is blende, and contains 67 per cent of zinc and 33 per cent of sulphur.—We have received, in a box without any address, 1 specimen of valuable hematite ore, 1 of trap rock, and 4 of a conglomerate containing red hematite, from Bucks county, Pa.

H. L. asks: What kind of a purchase is the best to pull up a drive well pipe with? I have used a chain and two jack screws, but it is a great deal of trouble and hard work to keep the chain from slipping.—C. W. J. asks: What is the best and speediest plant for a good, compact, and secure hedge?—G. W. W. asks: How can I pulverize mica very fine in large quantities?—W. E. C. asks: 1. Has chloride of aniline been successfully employed in the production of a good black on wool, more especially on felt hats? 2. Which is the best mode of dyeing a bright black on felt hats?—G. H. F. asks: What is the ornamental work on stove patterns made of? What will make it adhere to the wooden pattern?—A. J. H. asks: How is a silver gray color produced on fancy panel work, picture frames, etc.?—B. A. asks: Were any plants indigenous to the North imported into the South by means of our armies during the late war (see p. 131, vol. 32)?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Talking Ants. By W. C.
On Alkaloids by Synthesis. By R. B. W.
On Spiritualism. By T. B.
On a New Tempering Composition. By T. J. B.
On a Prolific Snake. By A. A. R.
On High Lakes. By S. T. W.
On Glycerin in Boilers. By W. F.
On Domestic Medicine. By G. H. J.
On Kaolin. By C. T. S.

Also enquiries and answers from the following:

J. M. S.—J. D. H.—A. O.—W. M.—C. B. L.—C. C.—T. B. G.—R. T. P.—E. A. M.—L. A. E.—C. K.—C. S. B.—T. F. M.—S. E. P.—O. M.—W. P.—S. S. A.—O. C.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who sells aniline blue dyes? Who deals in manganese? Who makes wooden paper hangings? Who sells horse radish graters? Who sells giant powder? Who sells a substitute for cloth for billiard tables? Who sells the cheapest toy engine? Who sells boilers for heating large buildings? Who will sell a right to use a gold plating process?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week ending

March 2, 1875,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Stove, heating, M. A. Cushing	160,398
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Telegraph solution, chemical, T. A. Edison. 160,402,	3, 4.
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Torch, policeman's, Clark *et al.*	160,393
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Vehicle, spring, J. Walker	160,488
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Washing machine, A. G. Huey	160,435
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Whalebone, straightening, W. H. Ferguson	160,411
Whiffletree clip, J. A. Ellis	160,262
Window sill, J. L. Rowland	160,284
Wrench, pipe, C. H. Fulmer	160,415

DESIGNS PATENTED.

8,180.—SHOW CARD.—J. Fuld, New York city.
8,181 & 8,182.—STATUARY.—J. Rogers, New York city.
8,183 to 8,185.—SHOW CASES.—L. Wiegel, Cincinnati, O.
8,186.—FOUNTAINS.—J. W. Fiske, New York city.
8,187.—VASE, ETC.—J. Hoare, Corning, N. Y.
8,188 to 8,190.—OIL CLOTHS.—C. T. Meyer *et al.*
8,191.—SODA WATER APPARATUS.—F. H. Shepherd *et al.*, Lowell, Mass.
8,192.—CARPET.—T. J. Stearns, Boston, Mass.
8,193.—DENTAL STAND.—S. S. White, Philadelphia, Pa.

TRADE MARKS REGISTERED.

2,262.—WASHING POWDER.—Corbett & Co., Chicago, Ill.
2,263.—WHEAT FOOD.—Durkee & Co., New York city.
2,264.—MEDICINE.—Gowdey & Co., New York city.
2,265.—PICKLES, ETC.—Heinz & Co., Pittsburgh, Pa.
2,266.—WATCHES.—J. W. Tucker, San Francisco, Cal.
2,267.—COTTON MACHINES.—R. H. Allen & Co., N. Y. city.
2,268.—LINIMENT.—C. Couch, New Haven, Conn.
2,269.—GLOVES.—Harris Brothers, New York city.
2,270.—POULTRY FOOD.—Sherwood & Co., Hartford, Ct.
2,271.—BONNETS, ETC.—S. C. Talcott, Ashtabula, Ohio.
2,272.—FANS.—S. C. Talcott, Ashtabula, Ohio.
2,273.—HATS, ETC.—S. C. Talcott, Ashtabula, Ohio.
2,274.—FRUIT MILLS, ETC.—Higganum M'f'g. Co., Conn.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, MARCH 1 to 6, 1875.

4,444.—L. B. Doan, Yarmouth, Ont. Adjustable Stove Pipe Shelf. March 1, 1875.
4,445.—J. Thompson, Crestline, Ohio, U. S. Face Tester for Millstones. March 1, 1875.
4,446.—Wm. Trabue, Louisville, Ky., U. S. Needle machine. March 1, 1875.
4,447.—E. S. Yentzer, Ottawa, Ill., U. S. Pantaloon stays. March 1, 1875.
4,448.—T. Prior, Carroltown, Miss., U. S. Churn. March 1, 1875.
4,449.—D. F. Mosman, Chelsea, Mass., U. S. Steam Heater. March 1, 1875.
4,450.—E. Davids and C. K. Jones, Bronte, Ont. Fumigating and Fire-Lighting Coal Oil Can. March 3, 1875.
4,451.—Wm. J. Manchester, Jr., Stittsville, Ont. Folding sash window. March 3, 1875.
4,452.—C. A. Shaw, Boston, Mass., U. S. Oxidized Lamp Wick. March 3, 1875.
4,453.—J. G. Taylor *et al.*, Port Huron, Mich., U. S. Extension Fire Ladder. March 3, 1875.
4,454.—H. Neilson, Toronto City, N. Y., U. S. Gravity Battery. March 3, 1875.
4,455.—H. E. Casgrain *et al.*, Quebec, P. Q. Illuminating Gas Machine. March 3, 1875.
4,456.—C. C. Jordeson, Montreal, P. Q. Revolving Screw Windlass. March 4, 1875.
4,457.—H. Bolton, Elizabethtown, Ont. Dog Power. March 4, 1875.
4,458.—A. Trumble *et al.*, Ottawa, Ont. Washing Machine. March 4, 1875.
4,459.—R. P. Spice, 21 Parliament street, Westminster, Eng. Gas Apparatus. March 5, 1875.
4,460.—F. P. Laubach, Catasauqua, Pa., U. S. Water Cooler. March 5, 1875.
4,461.—J. S. Royce, Cuylerville, N. Y., U. S. Harvester. March 5, 1875.
4,462.—D. Moodie, Bell's Corner, Ont. Potato Digger. March 6, 1875.
4,463.—W. Harris, Danville, Vt., U. S. Stereoscopic Camera. March 6, 1875.

Advertisements.

Back Page - - - - - - - - $1.00 a line.
Inside Page - - - - - - - 75 cents a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

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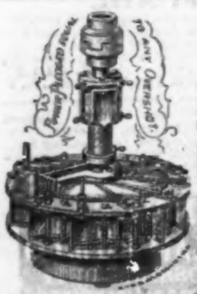

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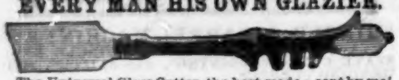

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